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INCOMPATIBILITY IN PRESCRIPTIONS.

By Joseph W. England, Ph.G.

Read at the Pharmaceutical Meeting, December 17th.

Incompatibility in a prescription has been defined as that condition in which there exists either "a chemical decomposition, a pharmaceutical dissociation, or a therapeutical opposition" of its constituents. The term is thus susceptible of three meanings. A prescription is chemically incompatible, where chemical change results. It is pharmaceutically incompatible where there is violation of correct pharmaceutical procedure, and there is therapeutical incompatibility where there is antagonism in physiological action. Now, accepting these definitions, a prescription may be chemically incompatible and yet be just what the physician wants. It may be pharmaceutically incompatible and yet be desirable for the same reason. But it is never compatible where there is a change of chemical composition and pharmaceutical character resulting in the formation of new products having totally different therapeutical effects than those obviously intended. And this view—the intended therapeutical action of the prescription—is the "keystone of the arch" and the best rule for the pharmacist to follow.

Every new prescription is largely a law unto itself until tried. Expertness in pharmaceutical manipulation, of which prescription work is the highest type, is a matter of individual ability which can be acquired, only in the largest and best measure, by personal experience. The subject of incompatibles is not a formidable one, if there primarily exists a clear knowledge of the chemical or pharmaceutical properties of the substances used, so that any deviation from the right standard may be detected, but here is the puzzling question: How are

we to know but that, in the event of some chemical or pharmaceutical change, the physician does not mean just such a change, and nothing else?

At first glance it seems strange, but there are some most successful physicians who, every now and then, write, pharmaceutically and chemically, the most incompatible prescriptions. Yet they have success. And their happy results can only be due to the formation of certain new products or an alteration in pharmaceutical character of old ones. It does not follow that all prescriptions thus written are of the highest therapeutical value. Far from it. The tendency of the times is steadily in the direction of greater simplicity in prescription writing.

It is to be regretted that the physician seems to depend in large measure upon the pharmacist for detecting any chemical or pharmaceutical incompatibility, and that the pharmacist depends, solely and alone, upon the physician for recognizing any therapeutical incompatibility. A physician with his many duties cannot be expected to have at his command the vast detail of pharmaceutical facts, nor can the pharmacist be considered negligent in not possessing an extended acquaintance with the application of drugs in medicine; but it is clear that some elementary knowledge as to how drugs act and for what purposes they may be employed would be of great practical value to the pharmacist in affording him a clear idea of the therapeutical intent of the prescriber, and the ability to detect any deviation through a chemical or pharmaceutical error. An argument for therapeutical knowledge is not a step in the direction of counter-prescribing. It is only a plea for broader education—for elementary therapeutics on distinctly pharmaceutical lines. With therapeutics, pure and simple, the pharmacist has nothing whatever to do. That is solely the province of the physician. Medicine and pharmacy are making rapid scientific progress, not in the same way, though co-laborers in the same cause, but upon certain definite lines of work and study, yearly becoming more distinct and widely separated, rendering each the more dependent on the other.

Concerning special instances of incompatibility, the writer, some time ago, devised a set of "notes," and they have been found of such good service, though doubtless much of the subject matter has been duplicated in your own personal experiences, that he feels impelled to present them in their entirety.

An important feature about which there seems to be some difficulty in remembering is the solubilities and insolubilities of inorganic compounds. To make such knowledge readily accessible, a modified table was framed, based almost wholly upon Prof. Attfield's "Statement of the Solubilities and Insolubilities of Salts," which expresses, directly or by inference, nearly 500 soluble and insoluble compounds of the following inorganic basylous radicals: aluminium, ammonium, antimony, barium, bismuth, cadmium, calcium, chromium, cobalt, copper, ferric, ferrous, gold, lead, lithium, magnesium, manganese, mercuric, mercurous, nickel, potassium, silver, sodium, stannic, stannous, strontium and zinc.

In using this table, it is only needful to remember the well-known chemical law: that when a solution of a compound is brought in contact with a solution of another compound, and, by an interchange of radicals, an insoluble compound is rendered possible, that compound will be precipitated.

Acetates are soluble.

Arseniates are insoluble, except those of the alkali metals.

Arsenites are insoluble, except those of the alkali metals.

Bromides are soluble, except mercurous and silver; those of antimony and bismuth are decomposed by water to form oxysalts.

Carbonates are insoluble, except those of the alkali metals.

Chlorides are soluble, except those of lead (*s*), mercurous and silver.

Citrates are soluble, except those of manganese, mercurous, silver and strontium, aluminium (*s*), barium (*s*), bismuth (*s*), cadmium (*s*), calcium (*s*), lead (*s*), zinc (*s*).

Cyanides are insoluble, except the mercuric and those of the alkaline metals and earths.

Hydrates are insoluble, except those of barium, strontium, calcium (*s*) and lead (*s*) and the alkali metals.

Iodides are soluble, except those of antimony, bismuth, gold, lead (*s*), mercuric, mercurous, platinum (*s*) and silver.

Nitrates are soluble.

Oxalates are insoluble, except those of antimony (*s*), chromium, ferric (*s*), ferrous (*s*), stannic, and the alkali metals.

Oxides are insoluble, except those of barium, strontium, calcium (*s*), and the alkaline metals.

(*s*) means sparingly soluble.

Phosphates (ortho) are insoluble, except those of the alkali metals.

Sulphates are soluble, except those of barium, strontium, calcium (*s*), antimony, lead, mercurous (*s*) and silver (*s*).

Sulphides are insoluble, except those of barium, calcium (*s*), strontium, and the alkali metals.

Sulphites are soluble, except those of aluminium, antimony, barium, bismuth, calcium (*s*), cobalt (*s*), copper, ferrous (*s*), lead, manganese (*s*), nickel (*s*), silver, stannous, strontium and zinc (*s*).

Tartrates are soluble, except those of antimony, barium, bismuth, cadmium (*s*), calcium (*s*), copper (*s*), ferrous (*s*), lead, manganese (*s*), mercuric, mercurous, nickel (*s*), silver, strontium (*s*) and zinc (*s*).

Acids decompose hydrates, carbonates and acid carbonates to form salts; the stronger acids, which are largely inorganic, set free the weaker acids, which are largely organic, or, brought in contact with alcohol or alcoholic solutions, form ethers; alkaline hydrates, carbonates and acid carbonates neutralize free acids, decompose some glucosides and precipitate all alkaloids, some of which precipitates are soluble in excess of the precipitant, or in alcohol, if that liquid be present in sufficient amount to dissolve them.

Oxidizing agents such as nitric, hydrochloric, nitro-hydrochloric, picric and chromic acids, and potassium bichromate and permanganate, with readily oxidizable substances, such as carbohydrates, alcohols, ethers, sulphur, phosphorus, sulphides, and organic matter in general, form explosive compounds. Potassium permanganate, if ordered in pill form, can best be made with cacao butter, and cosmoline in very small quantity, and enclosed in gelatin capsules. Silver nitrate is reduced by organic matter to oxide, with the exception, it is said, of opium and extract of hyoscyamus. A very good way of making pills of it is with cacao butter and cosmoline, etc., as mentioned above, under potassium permanganate; syrup of ferrous iodide and potassium chlorate form a poisonous compound, and potassium iodide and potassium chlorate form a mixture which yields the poisonous iodate on being taken internally.[1]

Iodine and the iodides yield precipitates with the alkaloids; bromides precipitate morphine and strychnine salts on standing, but a few drops of dilute hydrochloric acid added, after the addition of the alkaloid, prevents the change. Sodium biborate precipitates mor-

(*s*) means sparingly soluble.

[1] Am. Jour. Phar., 1876, p. 277.

phine and cocaine salts, but on the addition of a small quantity of boric acid, or with boric acid alone, precipitation does not take place. Mercuric chloride with acidulated solutions of the alkaloids forms crystalline double salts; potassium-mercuric iodide precipitates alkaloidal solutions. Solutions of quinine salts with those of the alkaline acetates, or with Basham's mixture, precipitate the sparingly soluble quinine acetate. Morphine solutions give the phenol reaction, if mixed with tincture of ferric chloride.

Glucosides are decomposed by free acids and precipitated by tannin; tannic and gallic acids precipitate alkaloids, albumen, gelatin and the majority of metallic salts, and yield inks with iron solutions.

Resinous tinctures and fluid extracts, prescribed with aqueous solutions, should always be emulsified with acacia; tinctures and fluid extracts made of stronger alcohol, mixed with those made of diluted alcohol, become turbid and precipitate, since the special solvent power of alcohol, or of water, for a substance diminishes in proportion to the quantity of the other liquid present. A "shake" label should always be used.

When for internal use, fixed and volatile oils and oleo-resins, and aqueous solutions, should always be emulsified, whether ordered or not, and, to better emulsify the volatile oils, they should have mixed with them, prior to emulsification, an equal volume of olive, almond or cottonseed oil.

Tincture of ferric chloride gelatinizes mucilage of acacia; free acids separate insoluble carminic acids from compound tincture of cardamom; free acids precipitate glycyrrhizin from fluid extract of licorice.

Commercial spirits of nitrous ether liberates iodine from solutions of iodides, decomposes antipyrine solutions to form a green nitro-derivative, and precipitates mucilage of acacia, but if it be well diluted with water it can usually be added last without precipitating. Tincture of guaiac and spirits of nitrous ether are stated to be pharmaceutically incompatible by Potter (although they are often prescribed together), likewise infusion of wild cherry with compound infusion of gentian, infusion of cinchona with compound infusion of gentian, and infusions with metallic salts generally.

Sodium salicylate in solution precipitates the sparingly soluble salicylic acid if mixed with acids, and yields, if dispensed in powders with potassium acetate, the very deliquescent potassium salicylate. Sodium salicylate in strong solution is decomposed by tincture of ferric

chloride, but if well diluted first changes only into ferric salicylate. Sodium benzoate solution is decomposed by acids to yield the sparingly soluble benzoic acid.

Mercuric chloride is decomposed by solution of potassium arsenite, but if the alkaline solution has first added to it, in slight excess, diluted hydrochloric acid no precipitation will take place on the addition of the mercurial salt; pyrophosphate and phosphate of iron solutions precipitate with dilute phosphoric acid. The National Formulary recommends the usage of dilute metaphosphoric acid, in place of the officinal "ortho" variety, as yielding a permanently clear solution.

In conclusion, the writer would say that in these "notes" presented he has endeavored to give, not an exhaustive list of special incompatibles, but simply a general expression of those liable to occur in the every-day routine of prescription work.

What to do with an incompatible prescription is a question for individual judgment and cannot here be entered into. The usual practice, in the event that the prescription involves no serious change, is to accept the situation and dispense as written. On the other hand, where some serious change is liable to take place, it is almost superfluous to state that it is the duty of the pharmacist to consult the physician before dispensing.

THE PURIFICATION OF BENZIN FOR PHARMACEUTICAL AND CHEMICAL PURPOSES.

By George M. Beringer, Ph. G.

Read at the Pharmaceutical Meeting December 17, 1889.

The U. S. Pharmacopœia of 1880 introduced benzin, describing it as a purified distillate from American petroleum, consisting of hydrocarbons chiefly of the marsh gas series and homologous compounds, having a sp. gr. from 0·670 to 0·675 and boiling at 50° to 60° C. (122° to 140°F.). It is required to be free from heavy hydrocarbons, pyrogenous products and sulphur compounds.

The British Pharmacopœia requires a boiling point of 50° to 60°C. (122° to 140°F.), but allows a much wider range of gravity, viz.:— 0·670 to 0·700.

The German Pharmacopœia describes benzin as a colorless non-fluorescent fractional distillate of petroleum of the sp. gr. 0·640 to 0·670, distilling over almost completely between 55° to 75°C.

The U. S. Pharmacopœia, by limiting the product to a sp. gr. of

0·670 to 0·675, admits of but a very small portion of the distillate, corresponding to a commercial benzin of 78°B. being used. It is safe to say that none of the commercial so-called deodorized benzins, and but very little of the petroleum ether sold for chemical purposes, answer the pharmacopœial requirements. What is generally supplied the pharmacist, when he orders benzin, is a distillate of 65°B. (sp. gr. 0·717) or, frequently, even as high a gravity as 62°B. (sp. gr. 0·729) is supplied. If he is somewhat particular, he may procure 75° B. (sp. gr. 0·680), but benzins from 75°B. to 90°B. are generally supplied as gasoline. Every sample of commercial deodorized benzin that I have been able to procure, has been so contaminated with pyrogenous and sulphurous impurities as to be totally unfit for pharmaceutical purposes, and the petroleum ethers, while cheap enough to be used as solvents in chemical analysis are too expensive for pharmaceutical use.

The solvent properties of benzin render it a valuable agent in the laboratory and I have no doubt that, in the near future, it will be used in many of the processes of pharmacy, such as the preparation of plasters, the extraction of fats and oils from certain drugs before percolation, such as nux vomica, ergot and strophanthus, or of caoutchouc-like substances from others such as lactucarium.

A process by which the pharmacist can easily, safely and cheaply purify benzin seems to me to be a desirderatum. It was surmised that the sulphur compounds could be removed by oxidation with potassium permanganate. As the result of experiments the following process was devised.

Take of Potassium permanganate.....one ounce avoir.
Sulphuric acid.....a half pint.
Water.....three and a half pints.

Mix the acid and water and when the mixture has become cold, pour it into a two-gallon bottle. Add the permanganate and agitate until it is dissolved. Then add

Benzin.....one gallon.

and thoroughly agitate. Allow the liquid to remain in contact for 24 hours, frequently agitating the mixture. Separate the benzin and wash in a similar bottle with a mixture of

Potassium permanganate.....¼oz avoir.
Soda.....½oz. avoir.
Water.....2 pints.

Agitate the mixture frequently during several hours. Then separate the benzin and wash it thoroughly with water.

On agitating the benzin with the acid permanganate solution, an emulsion-like mixture is produced which separates in a few seconds, the permanganate solution slowly subsiding and showing considerable reduction. The time specified (24 hours) is greatly in excess of what is necessary, as the reduction takes place almost entirely in a very short time, and I have no doubt that if the process were adopted on the manufacturing scale, with mechanical agitators, the time could be reduced to an hour or two.

The quantity of permanganate necessary is in direct proportion to the impurities existing in the benzin. The quantity ordered in the formula is sufficient for a pretty foul benzin and may be reduced with a purer distillate.

The samples shown were samples of commercial 75° and 88° gasoline which, as received from the refinery, were anything but sweet. The 75° showed a sp. gr. of 0·6845, and, after being thus purified, the sp. gr. remained the same. On evaporating from the hand, it left no disagreeable odor, and 50 cc. eveporated entirely in a platinum dish below 70° C. (158° F.), leaving no residue. When tested for sulphur compounds, by boiling with ammoniacal alcohol and then adding silver nitrate solution, it gave negative results. Shaken with warm distilled water and the water, separated, tested with $BaCl_2$ for sulphates, gave no reaction.

The sample of 88°, when received from the refinery, was exceedingly rank, as you will perceive from the sample shown. It seems that the lighter the benzin the more it is contaminated with sulphur compounds. It showed a sp. gr. of 0·6476. After treating as described, its sp. gr. was 0·6484. On evaporation from the hand, it had a peculiar almost ethereal, but not disagreeable odor. 50 cc. evaporated from a platinum dish entirely below 50° C., leaving no residue and, when tested for sulphur compounds and sulphates, as described, gave negative results.

For the preparation of petroleum ether for plant analysis, etc., where an exceptionally fine article is desired, it is only necessary to rectify this last purified article by fractional distillation from lard or other fatty substance, as recommended by Dragendorff, collecting only that portion which distils below 45° C.

Sample No. 5 has been thus prepared and shows sp. gr. of 0·641 and is exceedingly volatile and devoid of odor.

THE OILS OF WINTERGREEN AND BIRCH.

By Henry Trimble and Hermann J. M. Schroeter.

Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy, No. 64.

Read at the Pharmaceutical Meeting December 17th.

Under the above title we published in this Journal for August, 1889, page 398, a paper which has recently been criticized at considerable length by Prof. F. B. Power in the *Phar. Rundsch.*, of New York, December, 1889. This critic states that "good and sufficient reasons might be presented for inferring *a priori* the incorrectness of many of their [our] statements," and with this preliminary bias he proceeds to substantiate his belief by examining a sample of (1) oil of wintergreen, (2) oil of birch which, however, he claims was adulterated, and (3) "synthetic oil of wintergreen," furnished him by the agents of the manufacturers.

We proposed a new method for separating the hydrocarbon from the above natural oils by agitating the saponified mixture with ether or petroleum ether. Prof. Power is unable to get results agreeing with ours; he, however, now finds that the hydrocarbon is a viscid liquid, a fact he had not previously noted until we found it to solidify at about 10° C., but he will not admit that we determined its vapor density, because in his fruitless efforts to carry out the same process he found it decomposed at the temperatures of 300°, 360° C. (!!) and over, which he employed.

We suggest to him that no one but a novice would think of taking the vapor density of such an easily decomposable substance at from 100° to 200° above its boiling point. We, therefore, feel justified in endorsing his language and saying that *his* efforts "possess no scientific value."

We saponified our oils at the temperature of a water-bath in one-half hour, and are of the opinion that a lower temperature and shorter time will accomplish the purpose. Mr. H. P. Pettigrew[1] boiled the oils he investigated for six hours with a concentrated solution of potassium hydrate. Is it remarkable that he did not find a hydrocarbon in oil of birch? During such an ordeal it was either decomposed or escaped condensation. Since Prof. Power has repeatedly called attention to the fact that Mr. Pettigrew's experiments were con-

[1] Amer. Jour. of Pharm., 1883, p. 386.

ducted under his direction, it would be a matter of interest to know why he suggested such unreasonable treatment, and why he now boils the mixture for only two hours. He might also explain why he allowed Mr. Pettigrew in the same investigation to record the specific gravity of 1·0318 for oil of wintergreen at 22° C.

Prof. Power's experience with oil of birch narrows down to the investigation of Mr. Pettigrew, and more recently his own on what he claims was an adulterated sample, which adulteration, if true, would certainly render his results worse than useless. In view of the above it is not surprising that he failed to find benzoic acid in the natural oils, and his method of attempting to throw doubt on the occurrence of ethyl alcohol in the oils, by vague statements about oil of turpentine producing the iodoform reaction, is simply pitiable. Right here, therefore, we may say with emphasis that such reasoning at the writing table will not take the place of figures obtained in the laboratory.

In regard to the third sample examined by Prof. Power, which he designates "synthetic oil of wintergreen," we suggest that it would have been more in accordance with *his* results, had he named it "synthetic oil of birch." It would have been more scientific had he procured his sample in the open market as we did. In reply to the elaborate reasoning by which he attempted to show that our sample could not have contained benzoate of methyl, we answer that we purposely said nothing about benzoate of methyl, but merely stated that benzoic acid was present in the sample of artificial oil examined by us. It is our opinion that it was a mixture of methyl salicylate, ethyl salicylate and ethyl benzoate. Such a product could easily be made to conform with the specific gravity and boiling point given. As the artificial oil was of secondary importance in our work, we did not attempt to investigate the alcohol, and therefore merely stated that we found benzoic acid.

Finally in his summary Prof. Power flatly contradicts himself when he asserts that the artificial cannot be distinguished from the natural oil by adding an "excess of potassium hydrate" as stated by us. He says "on heating either of these oils," that is, the natural or artificial product, "with a caustic alkali the wintergreen odor is naturally destroyed since the chemical compound to which the odor is due becomes thereby decomposed." It is true that the methyl salicylate is decomposed and *its* odor disappears, but what becomes of the hydrocarbon? We admit that the latter might be, and probably is decom-

posed, by boiling with concentrated alkali for six or even two hours, but every one who has prepared the acid from natural oil of wintergreen or birch knows the difficulty attending the separation of the acid from the persistent odor of the hydrocarbon.

We consider this a cardinal point, and, therefore, we have shown at a pharmaceutical meeting in the Philadelphia College of Pharmacy that the natural oils retain a pleasant odor after warming with a concentrated solution of potassium hydrate in a test tube, while the artificial oil, of which we showed three different samples, loses all agreable odor almost immediately on the addition of the same reagent.

In conclusion we hope the Pharmacopœia Committee will in no way recognize the artificial product, since if we accept Prof. Power's statement it is manufactured almost exclusively by one firm.

The Pharmacopœia is published for the physician and pharmacist, and it will be ample time to recognize the artificial oil when physicians commence to designate it in their prescriptions, which is not likely to be the case as long as they write for salicylic acid from the natural oil.

With this we close our notice of any further remarks by others unless such criticisms are accompanied by evidence of more elaborate laboratory work.

CHEMICAL NOTES.

By Henry C. C. Maisch, Ph. G., Ph. D.

Examination of two species of Polygala.—L. Reuter (meeting of scientists and physicians, Heidelberg, through *Pharm. Centralh.*, 1889, p. 609) obtained from the root of *Polygala alba* senegin, 1·067 per cent.; resin, 0·85 per cent.; fatty oil, 0·2 per cent.; methyl salicylate, a trace. A Japanese senega (according to Shimoyama, possibly *P. tenuifolia*), yielded 9·6 per cent. of a brownish-yellow mass, which consisted of 0·8 per cent. resin and 8·8 per cent. oil methyl salicylate as above, the odor, however, resembled patchouly.

Constituents of Urtica urens and U. dioica.—The same author (*l. c.*) extracted from the powdered leaves after treatment with slaked lime and water and evaporating a glucoside which was free from nitrogen and gave precipitates with the following reagents: Iodo-iodide of potassium, potassio-mercuric iodide, platinum chloride, mercuric chloride, palladium chloride, phospho-tungstic acid. Potassium ferricy-

anide is reduced, as is also potassium chromate in presence of sulphuric acid. Tannin, sodium chloride, ammonia, sodium hydrate, sodium carbonate and bicarbonate have no effect. The aqueous solution is neutral.

From the seeds of *U. pilulifera*, which in the Orient are highly spoken of as a galactopœum, the same author (*l. c.*) extracted also a glucoside. The powdered seeds were treated with magnesia and water, the mixture evaporated to dryness and extracted with chloroform. He obtained an oil rich in chlorophyll. The residue from the above was extracted with absolute alcohol, the latter distilled off, and the remainder taken up with water. On acidifying this solution with hydrochloric acid it yielded with iodo-potassium iodide a copious precipitate. Its behavior towards Fehling's solution before and after treatment with acids showed it to be a glucoside.

Eschscholtzia californica, according to the same author (*l. c.*) contains two alkaloids and a glucoside. One of the alkaloids, *protopine*, which is widely distributed through the papaveraceæ, has, according to E. Schmidt (meeting of scientists and physicians, Heidelberg, through *Chem. Centralh.*, 1889, ii, p. 579), a physiological action similar to that of morphine. One of the alkaloids gives a violet color with sulphuric acid.

The root of *Berberis aquifolium* contains, according to E. Schmidt (*l.c.*) berberine, oxyacanthine, berbamine and phytosterin. He found the composition of berbamine and oxyacanthine to be $C_{18}H_{19}NO_3$. The purification of berberine is best accomplished by the following method: A salt of berberine is dissolved in water, acetone and sodium hydrate added, and after the liquid has cooled the crystalline acetone—berberine is collected and washed. The berberine salts are obtained by boiling the above compound with dilute acids, and the free alkaloid by heating with chloroform and alcohol; these solvents are distilled off, and after cooling the alkaloid is recrystallized from water. The alkaloid obtained differs in some respects from that prepared according to the older method (decomposition of the sulphate with barium hydrate, removing excess of barium with CO_2, evaporating in vacuo and recrystallizing), the latter giving off 6 mol. water at 100° C., the former only 4 mol.; the former further does not absorb CO_2, while the latter does, forming an acid carbonate.

According to the same author the root of *chelidonium* contains chelidonine, ($C_{20}H_{19}NO_5 + H_2O$), chelerythrine, and a number (about a dozen) of

other alkaloids. From the raw alkaloid of Merck he isolated three further alkaloids, α- and β-homochelidonine and protopine. The latter alkaloid has also been found in Sanguinaria canadensis (besides a number of others), Stylophorum and Eschscholtzia californica (previously taken for morphine in this plant). The chelidonium alkaloids resemble morphine in physiological action. The stylophorine, from the root of *Stylophorum diphyllum*, is identical with chelidonine.

Further, the above author reported some investigations on the mydriatic alkaloids. The length of keeping *belladonna root* has no effect on the alkaloid present, this being principally hyoscyamine. The time of collecting, however, has an influence, the first year's root containing hyoscyamine and atropine.

Scopolia atropoïdes and *Sc. japonica* contain hyoscyamine and hyoscine; the latter has been obtained in a crystalline form by C. J. Bender. Traces of a mydriatic alkaloid have been noticed in *Sclanum tuberosum*, *S. nigrum* and *Lycium barbarum*.

Oil of Andropogon Nardus or *citronella oil.*—T. D. Dodge, *Am. Chem. Jour.*, 1889, p. 456. According to the preliminary notice the author obtains somewhat different results from Kremers (Proc. Am. Pharm. Assoc., 1887, p. 562). The aldehyde, isolated from the oil by means of a concentrated solution of sodium bisulphite, according to Kremers is $C_7H_{14}O$ while Dodge obtains results corresponding to $C_{10}H_{18}O$ and names the compound citronellic aldehyde. By the action of P_2O_5, an oily product, probably a terpene, was obtained. By heating the dibromide of the aldehyde the distillate contained a small quantity of oil having the odor of cymene, $C_{10}H_{14}$, thus confirming the statement of C. R. A. Wright (*Jour. Chem Soc.*, 1875, p. 1). Oxidation with potassium permanganate yielded a mixture of fatty acids smelling strongly of ordinary valerianic acid. A portion of the oil boiling at 77° C. is very likely a terpene. The portion boiling at 222° C. is probably citronellyl alcohol, $C_{10}H_{20}O$, the same as obtained by the reduction of citronellic aldehyde, the acetyl derivatives of both having the same characteristic odor. The oil is, according to this author, similar in composition to oil of tansy, examined by Bruylants (AMER. JOUR. PHAR., 1878, p. 254), who found an aldehyde, $C_{10}H_{16}O$, the corresponding alcohol, $C_{10}H_{18}O$, and a terpene.

Dextrorotary honey.—C. Amthor and J. Stern (*Zeitschr. f. angew. Chem.*, 1889, p. 575), examined two specimens of Alsatian honey, one

from Neuweiler im Steinthal, rotation +10·7° Laurent, and the other from Upper Alsatia, showing +10·26° Laurent in a 200 mm. tube. The rotation was due to a dextrin, of which the former contained 6·1209 per cent. the latter 9·03 per cent. Both honeys were natural products.

Olive Oils from various sources.—L. Archbutt (*Jour. of Soc. Chem. Industry*, vii, 1889, p. 685–686, through *Chem. Centralb.*, 1889, ii, p. 886) examined 70 Spanish oils, 10 of which were adulterated, the percentage of free, fatty acids varying from 25·1 per cent., the highest, to 1·5 per cent., the lowest, the average being 5·5 per cent. Of 29 Italian oils only one was adulterated. Fatty acids: highest, 25·2 per cent.; lowest, 0·9 per cent.; average, 8·5 per cent. Only 9 of 22 Sicilian oils were pure. Fatty acids: highest, 16·6 per cent; lowest, 0·5; average, 9·1 per cent.

Reactions of Oil of Sesame.—W. Bishop (*Jour. de Pharm. et de Chim.* (5), xxx (1889), p. 244–247) states that ol. sesame which has been exposed to air and sunlight for a few days gives a green color when shaken with hydrochloric acid 21–22° B. (sp. gr., 1·1670–1·1763). According to the author, 5–10 per cent. of sesame oil may be detected in olive oil by this method. The oil is exposed to the action of sunlight and air for a few days and then 6–8 cc. of the oil shaken with 12–14 cc. HCl of above strength in a stoppered flask holding about 35 cc.

Estimation of Morphine in Opium.—Prof. F. A. Flückiger (*Arch. d. Pharm.*, 1889, p. 721–732) estimates morphine in the following manner: 8 gm. of powdered opium are placed in a plaited filter 12 cm. in diameter, the funnel being slightly tapped in order to bring the powder to the bottom, and the whole dried at 100° C. After half an hour, a mixture of 10 cc. chloroform and 10 cc. ether is poured on the powder, the funnel being covered and tapped a number of times; then 10 cc. chloroform additional are poured on. After the liquid has drained off, the filter is spread out and the powder dried at a slightly elevated temperature. The powder is then shaken with 80 gm. water to which has been added 0·2 gm. ammonium oxalate to separate the calcium present, and filtered after two hours. 42·5 gm. of the filtrate are treated in a small tared flask with 7·5 cc. alcohol (sp. gr., 0·83), 15 cc. ether and 1 cc. ammonia (sp. gr. 0·96). After six hours, having shaken often, the contents of the flask are poured on two plaited filters, one inside of the other, and 10 cm. in diameter, the flask being rinsed with 10 cc. water or an aqueous solution of

morphine (1 : 5,000) and poured on the filters. These are dried at slightly elevated temperatures and at last at 100° C. The morphine is then transferred to the flask which has been dried at 100° C., and the whole heated to this temperature until constant. The morphine obtained represents one-half the quantity of the opium.

GLEANINGS FROM THE GERMAN JOURNALS.

By Frank X. Moerk, Ph. G.

Commercial Ether.—In an examination of the oxychlorides of mercury K. Thümmel attempted to remove by agitation with ether an excess of mercuric chloride from a solution of monoxychloride of mercury in sodium bicarbonate; but this was found to be impossible as the ethereal solution after some minutes became turbid and deposited a white precipitate. The elaborate researches made to ascertain the nature and source of this precipitate disclosed that all samples of ether, made by him or purchased, showed the same behavior and that this was due to the presence of *vinyl alcohol, which is a constant impurity of commercial ether.* The vinyl alcohol is formed in the manufacture of the ether and is the product of oxidation of pure ether by atmospheric oxygen with formation at the same time of hydrogen peroxide; it is also formed by the action of hydrogen peroxide, ozone and chromium trioxide upon ether. Vinyl alcohol may be removed from the ether by repeatedly agitating with water, or an alkaline solution of mercuric monoxychloride; by phenyl-hydrazin; by treatment with bromine; or by decomposing it with potassium hydrate. The liberation of iodine from iodides, especially in presence of acetic acid, is due to the presence of hydrogen peroxide in the ether, while the brown coloration on addition of potassium hydrate is caused by the vinyl alcohol; an acid reaction of the ether is traceable to acetic acid which is the main product of oxidation of vinyl alcohol. As the formation of vinyl alcohol and hydrogen peroxide is especially promoted by exposure to light, and experiment has shown that perfectly pure and anhydrous ether also undergoes similar changes, the requirement to preserve ether in a dark place is apparent. For pharmaceutical and medicinal uses an ether of neutral reaction, which does not liberate iodine from iodides and which does not become discolored by agitation with potassium hydrate solution, should be pro-

vided. Chemically pure ether may best be prepared by the addition of 7 to 9 gm. phenyl-hydrazin to 5 kilos. ether and subsequently rectifying; good results may also be obtained by treating the ether with a strong potassium hydrate solution and rectifying; this latter method is at present practically employed.—Th. Poleck and K. Thümmel, *Arch. der Pharm.*, 1889, 961.

Dispensing of Thymol Powders.—If thymol be powdered in a porcelain mortar the thymol becomes so highly electrified as to adhere provokingly to all substances with which it comes in contact; it somewhat deports itself like a very deliquescent substance. F. Sengewitz overcomes the difficulty by powdering in an iron mortar, using small quantities at a time and exerting little pressure.—*Pharm. Ztg.*, 1889, 706.

Ethyl bromide has lately been so successfully used in dental operations that preference is given to it over chloroform, nitrogen monoxide and cocaine salts; its success is ascribed to the purity of the chemical as at present made from alcohol, potassium bromide and sulphuric acid. It resembles chloroform in that the pure substance is easily decomposable, and the addition of one per cent. of alcohol or ether retards or prevents the decomposition. The specific gravity of pure ethyl bromide at 15°C. is 1·4735, while that containing one per cent. alcohol is 1·457 at 15° C. Tests of purity are: 1. The absence of color when shaken with an equal volume of concentrated sulphuric acid, and 2. water agitated with ethyl bromide, after separation, should not react acid, nor give a turbidity with silver nitrate solution.—Dr. H. Thoms, *Pharm. Ztg.*, 1889, 705.

Cocaine chromate.—Dr. Karl Mezger uses the formation of this salt as a test for cocaine in as dilute solutions as 1:1,000. The test of identity is applied by dissolving 0·05 gm. cocaine hydrochlorate in 5 cc. water and adding five drops of a five per cent. chromic acid solution; each drop forms a decided precipitate, which, however, again dissolves; after the addition of 1 cc. pure concentrated hydrochloric acid an immediate orange-yellow precipitate of cocaine chromate should appear.—*Pharm. Ztg.*, 1889, 697.

Soaps.—The preparation of soap always requires the use of an excess of alkali which should afterwards be removed by salting out the soap; to obtain a neutral soap this operation must be repeated several times, and the soap so obtained always retains some of the alkaline chloride. Dr. E. Geissler in a paper on this subject recom-

mends that after the saponification of the fat a definite portion of the soap be removed, dissolved in alcohol and titrated with an acid; from this determination the calculation is made as to the quantity of hydrochloric acid needed to neutralize the excess of alkali, and after the addition of this quantity of acid the soap is evaporated to the proper consistence. For the detection of free alkali in soap it is proposed to take powdered soap and cover it with a solution of mercuric chloride, free alkali being indicated by the appearance of a red coloration. Neutral soaps in contact with mercuric chloride did not change in color after three months time, while such soaps as indicated a slight alkaline reaction gradually blackened; of importance is the fact that only such medicinal soaps (containing 2 per cent. $HgCl_2$) as do not give color with mercuric chloride are of antiseptic value. A criterion of good sublimate soap, hence, is its color; a discolored soap being worthless and therefore to be rejected.—*Pharm. Ztg.*, 1889, 671.

Pill Masses.—Creasote pills have been recommended to be prepared by the use of wax or magnesia, but such pills placed in warm water for 24 hours remain intact and do not evince any signs of disintegration, showing the undesirability of these excipients. E. Dietrich gives a formula for a *creasote pill mass*, containing 25 per cent. creasote, which is plastic and will remain so for long periods if the quantity of glycerin given be doubled and the mass kept in well closed vessels. Creasote 10 parts are mixed with glycerin 2 parts and triturated with powdered extract of licorice 10 parts, finally incorporating powdered glycyrrhiza 18 parts. Pills made from this mass are easily disintegrated by the action of warm water; in dispensing the pills finely powdered coffee is advocated as a dusting powder.

For a *Copaiva pill mass* (25 per cent.) the following gives excellent results: Copaiva 10 parts, glycerin 2 parts, mix and incorporate in the order named powdered sugar 10, magnesia 10, powdered glycyrrhiza 8. *Turpentine pill mass* can be made in the same manner.—*Pharm. Centralhalle*, 1889, 676.

Ointment of Iodide of Potassium.—In place of some of the more recent additions to this ointment, made in order to prevent decomposition, E. Dieterich proposes again an older suggestion, namely the addition of medicinal soap. The formula requires 10 parts potassium iodide and one part powdered soap to be dissolved in 9 parts of distilled water and this solution incorporated with 80 parts of a firm paraffin ointment.—*Pharm. Centralhalle*, 1889, 677.

ABSTRACTS FROM THE FRENCH JOURNALS.

TRANSLATED FOR THE AMERICAN JOURNAL OF PHARMACY.

DECOLORATION OF SOLUTIONS OF IODIDE OF AMMONIUM.—These are colorless when recently prepared, but soon become yellow owing to a portion of the iodine being set free. Ammonia may be used as a decolorant, but an excess is required; hyposulphite of sodium acts well, but introduces too much tetrathionate of sodium; ether and chloroform, also, are used, but these are not perfectly soluble in water. M. Soucheire recommends that a small quantity of fecula be added to the solution of ammonium iodide, which is then well shaken and filtered. The iodide of starch thus formed remains upon the filter. The filtered solution contains no dissolved fecula; if a drop of tincture of iodine be added to it no deposit or blue coloration is observed.—*Bull. de la Soc. du Phar. du Sud-Ouest,* Aug., 1889.

PROPERTIES OF "ABSOLUTE" IODOFORM.—Suillot and Raynaud described their process of making iodoform from acetone, early in the year 1889 (AM. JOUR. PHAR., 1889, p. 175). The process is based upon the reaction of a hypochlorite upon an alkaline iodide, and the reaction of an alkaline hypoiodite upon acetone, thus giving rise to iodoform. In a communication by M. Casthélaz to the *Congrès de Thérapeutique* it is explained that at the factories near Rouen, iodoform is now made directly from the sodic mother-liquors of sea-weed. The iodide of sodium is taken from the cinders, and, on the following day, the total amount of iodine is precipitated as iodoform. The bromides of potassium and of sodium remain in the liquors, whence they are taken by the usual processes. Iodoform made by this process is called by Casthélaz, "absolute iodoform," because "iodoform by acetone is the result of a complete reaction, without production of free iodine capable of giving rise to iodic compounds; it is obtained directly from the alkaline iodides in a state of great purity, and may, perhaps, be considered absolute." In consequence of its purity, the odor of iodoform thus made is very weak; the substance appears in pale yellow, mica-like scales and is soluble without residuum in alcohol, ether, chloroform and the sulphide of carbon.—*Congrès de Thérapeutique,* 1889.

SOLUTIONS OF SALICYLIC ACID.—M. Barnouvin writes as follows to the *Répert. de Phar.*, Nov. 10: The name of solution as applied to the mixture of salicylic acid now in use, composed of salicylic acid, 1 gm.; glycerin, 20 gm., and distilled water, 80 gm., is a misnomer,

for an abundant precipitate is soon formed. I have sought to determine the proper amount of glycerin to be used from the point of view of the needs of practice, and have also endeavored to ascertain the exact quantity of water which it is possible to add to glyceric solutions. I found that 1 gm. of salicylic acid dissolved, with heat, in 50 gm. of glycerin, and gave no deposit on cooling. This degree of solubility is sufficient for many purposes, such as throat-collutories and other washes, which may be made as follows: Salicylic acid, 25 or 50 cgm., glycerin (28°B.) 25 gm.; dissolve with heat. In using a more concentrated glycerin, stronger salicylic solutions may be obtained. With regard to the addition of water, I found that 10 gm. of water added to a 1 to 50 glyceric solution of salicylic acid gave a precipitate. To solutions of 1 to 100, however, water may be added in all proportions.—*Répert. de Phar.*, Nov. 10.

Preparations of Naphthol.—Naphthol is often prescribed in potions which are usually made by dissolving it in twice its weight of ether, alcohol or glycerin and adding the solution to the potion. According to M. Mainiel, naphthol dispensed in this way soon precipitates. He proposes that the naphthol be dissolved in ten times its weight of the oil of sweet almonds. The solution is easily effected with the acid of gentle heat. Gum, syrup, etc. may be agitated with the oil to make an emulsion, in which the naphthol remains suspended in a condition of perfect division.—*Union Phar.; Répert. de Phar.*, Nov. 10.

Sensitive Reagent for Mercurial Vapors.—Professor Merget uses as a reagent a saturated, aqueous solution of nitrate of mercury treated with liq. ammonia until precipitation ceases. The preparation remains unaltered for several months. With this, a few lines may be traced on a sheet of paper and the excess absorbed with a blotter. One-half the sheet is then exposed to the action of the suspected vapors and is afterward compared with the other half, when the mercurial influence of the vapor is detected. The test is very sensitive.—*Bull. de la Soc. de Phar. de Bordeaux*, Sept.

Solidago Virgaurea in Cardiac Dropsy.—Dr. Mascarel is said (*La France médicale*, Oct. 8, 1889) to have used the plant very successfully in these cases. It has long been used by country practitioners to produce diaphoresis. It grows plentifully in the Northern parts of the United States, and resembles *Sol-odora*, the "sweet-scented golden rod," or "blue-mountain tea." In administering it for cardiac dropsy,

Dr. Mascarel reduces the dried plant—stems, leaves and flowers—to a coarse powder, and gives it in doses of one tablespoonful, beaten with an entire egg (yelk and white). He gives but one dose on the first day; but on each of the following days he adds a tablespoonful until seven or eight doses are being taken during the twenty-four hours. The diuresis is said to continue until œdema permanently disappears.

GUAIACUM AS AN EMMENAGOGUE.—The formula of Dr. Ménière's mixture is given in the *Rev. méd.-chir. des mal. des femmes*, as follows: Res. guaiac, 250 gm.; carbonate of sodium, 12 gm.; pimenta, 60 gm.; alcohol of 60 per cent., 100 gm.; macerate for 8 days in a dark cool place, filter, and add spirit of ammonia, 4 gm.; volatile oil of mint, 1 gm. Keep in yellow bottles perfectly sealed. The dose is one teaspoonful in good wine, three times a day, before eating. It is said to have a more reliable action than the other emmenagogues in use.

DERIVATIVES OF ACETYLPHENYLHYDRAZINE.—M. Petit (*Soc. de phar. de Paris*, Oct. 2) has prepared several of these by a less complicated process than that usually employed. He causes sodium to act directly upon acetylphenylhydrazine, which he then treats with iodide of methyl, thus obtaining methylacetylphenylhydrazine. By replacing the iodide of methyl with the iodide of ethyl he obtained ethylacetylphenylhydrazine. In the same way he prepared formylphenylhydrazine.

STERCULIA GUM: ITS SIMILARITIES AND DISSIMILARITIES TO TRAGACANTH.[1]

OCCURRENCE OF PARARABIN IN STERCULIA GUMS.

BY J. H. MAIDEN, F. L. S., F. C. S., Curator of the Technological Museum, Sydney.

The existence of a gum on species of *Sterculia* has long been known. It has been recorded from India, Africa and Australia, but with the exception of Flückiger's research in regard to an African species, and some general experiments with the India *S. urens*, nothing appears to be known in regard to them. The object of the present paper is to record some experiments and observations on the gums of Australian and also of an Indian species, in the course of which the author has discovered that they are composed essentially of *pararabin*, and also

[1] Read before the Pharmaceutical Society of Great Britain, at an Evening Meeting in London, Wednesday, November 13; reprinted from *Phar. Jour. and Trans.*, November 16, p. 381.

to show the incorrectness of the idea that they are similar to tragacanth, except in some superficial characteristics.

The author cannot at present see any commercial future before gum of the Australian species; the same conclusion has long since been arrived at in regard to those produced by India ones; in regard to an African species we have the experiments of Flückiger (*infra*).

INDIAN.

(Thirty-one species are described in the "Flora of British India.")

Many Indian species yield gums, but that of *S. urens*, Roxb., is best known. It is obtained from cracks and incisions in the bark, and is mixed with that of *S. villosa* and *Cochlospermum*, and sold under the name of "kalila" or "katira" (Brandis). It is used in India for making sweetmeats (*Cat. Kew Museums*). It exudes spontaneously during the hot season, and occurs in large, light-brown, transparent tough masses. Immersed in water these swell like a jelly, and do not dissolve but by protracted boiling. The solution is not adhesive, and is destitute of the thickness of solutions of ordinary gum. The uses of the gum are very limited; the want of adhesiveness renders it unsuitable for the arts, while its difficult solubility renders it inferior to most other gums for medicinal purposes (O'Shaughnessy, "Dispens."). From time to time samples have been sent to Europe for valuation, but hitherto no use has been found for it, and consequently it has no appreciable value in the markets. The only purpose for which it has hitherto been considered available is as an adulterant of tragacanth, but hardly as a substitute. Some samples either of this, or a very similar gum, have appeared in the London and Liverpool markets, and sold at a low price as false tragacanth and hog gum (Cooke, "Gums and Resins of India," where further particulars are given). Dr. Dymock (*Pharm. Journ.* [3], viii, p. 161) says, "Placed in water it forms a firm, colorless, tasteless jelly, but on the addition of a large quantity [not unless heated, J. H. M.] it dissolves; the solution is precipitated by acetate of lead. It is used as a substitute for tragacanth, and is issued from the Government stores." It would be interesting to know to what use the gum is put after issue, but the same author's "Materia Medica of Western India" throws no light on the subject.

Following are two extracts from a "Descriptive Catalogue of the Gums and Resins in the Technological Museum," which is nearly ready for the press.

Cochlospermum Gossypium, D. C., Kuteera or False Tragacanth. *Sample I.*—Received from Kew. A translucent, horny-looking, shrivelled gum, in irregular pieces as large as walnuts. It is of a dull dirty whitish, yellowish or brownish color, and attached to it are fragments of bark, some of it lace-bark (? sterculiaceous). To say that it is tragacanthoid describes its lustre. It is without taste. It might be used (if that *be* a use) as an adulterant, but not as a substitute for low-grade tragacanth, for it has not the adhesiveness of the latter gum. Mr. Baden-Powell (quoted by Cooke) states that it is used in shoe-making in India. If it has any adhesiveness at all in India it would be worth while to inquire whether it is employed as a substitute for tragacanth in cementing the "wrappers" of Indian cigars. Waring ("Pharm of India") speaks of it as an article of very minor importance. From India (N. W. P.). *Sample II.*—A beautiful selected translucent sample, resembling chalcedony. On tasting it, it was found to be quite acid, and on smelling, the bottle was found to be strongly charged with acetic acid.[1] As far as the samples in the Museum go, it appears to hold good that the paler the specimen, the more acidulous it is. From Calcutta. *S. urens*, Roxb. —Received from the Government of India. I cannot at present detect any difference between this gum and that of *Cochlospermum Gossypium*. I have even transposed the labels, and then have failed to separate the gums, except by guess-work. Some of the pieces taste slightly sour, as mentioned under cochlospermum. Digested in water it swells up and dissolves but slightly. It appears, however, to make a bulkier jelly than cochlospermum, but this difference may be only apparent, owing to the specimens not having been judiciously chosen. Guibourt discusses the subject (Cooke, "Gums and Resins of India," p. 30; *Pharm. Journ.*, xv, p. 58), and arrives at the conclusion that the two trees produce identical gums. Its chemical deportment is the same as that of *S. rupestris*, and the experiments related under the head of that gum (as also the description of its behavior in water) apply here exactly.

Dr. Thomson says the gum of *S. urens* has been used by calico-printers (*sic*), and in his "System of Chemistry," makes this particular gum a sub-division of the gums, as precipitable by a solution of silica (Gmelin).

[1] This was long since pointed out by Guibourt ("Hist. des Drogues," *Pharm. Journ.*, xv, p. 58).

There can be little doubt but that the following gum is attributable to *S. urens*, and the excerpt is interesting as giving a further description, and as placing the objections to its use in another form. The gum had been purchased by a calico-printer in ignorance. "It was in large brown-colored and wrinkled translucent pieces, having a certain degree of softness; so that they could not be pounded in a mortar. When put into water they did not dissolve, but gradually imbibed the water and swelled out into a jelly, so nearly colorless that its presence at the bottom of the vessel containing water was not perceptible till the water was agitated by moving the vessel. When boiled for some hours with water this jelly completely dissolved. But the water was not mucilaginous, like a solution of gum-arabic, nor had it the least adhesive property. . . Thus this substance, though resembling gum in its appearance, possessed none of the properties of that substance, and could not be employed to thicken acids or colors intended to be printed on cloth. . . There is reason to suspect that it came from India" (Thomson, "Chemistry of Organic Bodies, Vegetables," p. 676).

Following are the other oriental species yielding gum, as far as known to the author:—

S. campanulata, Wall. "Exudes a gum resembling tragacanth" (Kurz).

S. ornata, Wall. "Exudes gum" (Kurz).

S. fœtida, Linn. "Exudes gum resembling tragacanth" (Kurz).

S. villosa, Roxb. "Gives a white pellucid gum which exudes copiously from cuts in the bark (Gamble, Brandis). This gum bears the same local name as the produce of *S. urens*.

S. ramosa and *S. piperifolia*, from Pegu, are said by Balfour ("Cyc. of India") to yield gum, but I cannot at present trace these names. It may be that they are synonyms.

AFRICAN.

(Several species are described in the "Flora of Tropical Africa.")

S. Barteri, Mast. (*op. cit.*, 219), is reported to have "resinous" bark, but this is probably an instance of the commonly loose way in which the words "gum" and "resin" are used. A "whitish gum" exudes from the follicles of an undetermined species.

S. Tragacantha, Lindl. Lindley calls this the "gum tragacanth of Sierra Leone." According to Lock (Spon's "Encyc."), it bears the

closest resemblance to the produce of the Indian species of *Sterculia* just described, as is seen, indeed, from Dr. Flückiger's description. Lock states that it is formed in great quantity, and commonly finds its way into parcels of Senegal gum. If Flückiger's conclusions as to its utility are justifiable, it is singular that it has not come into use, but the present writer can find no further allusion to it anywhere.

The following notes on "African Tragacanth" from this species are abstracted from a paper by Dr. Flückiger (*Pharm. Journ.* [2], x, 641).

The substance experimented upon consisted of "irregular, knobby, undulated, droppy, or stalactitic masses, more or less bubbly or cavernous, often exceeding an ounce in weight, of a pale yellowish hue or almost colorless, in small fragments nearly transparent, but seen in mass somewhat opaque by reason of innumerable cracks, which also render it more brittle than true tragacanth. Each mass is, in fact, traversed by curved fissures answering to successive protrusions of gum. Fragments of bark are often adherent to the flat or inner side of the pieces.

"With twenty parts of water coarsely powdered African tragacanth forms, like common tragacanth, a thick, tasteless jelly; with forty parts of water the jelly becomes more fluid. Only a very small quantity of gum is really dissolved in the water; the filtered liquid is not precipitated either by neutral acetate of lead or by absolute alcohol,[1] but on addition of basic acetate of lead it becomes a little turbid. The jelly itself reddens litmus paper. Neither thin slices of the dry tragacanth nor the jelly exhibit any trace of cellular structure, or of starch, even when examined in polarized light by means of a microscope. In this respect the tragacanth of *Sterculia* differs from that of *Astragalus*. As a means of promoting the adhesiveness of pilular masses, I find the former, whether in the form of powder or mucilage, as advantageous as ordinary tragacanth.

"The fine powder on exposure for some days to a temperature of 212° F. loses 20·5 per cent. of its weight. The formula $C_{12}H_{22}O_{11}+5H_2O$ would exactly require 20·5 per cent. of water. . . . Upon incineration, the dried powder leaves 7·8 per cent. of ash, of which the prevailing constituent is carbonate of calcium. . . ."

Dr. Flückiger then reports the result of an ultimate analysis of the

[1] The formation of a ppt. by this reagent is rendered almost impossible in such dilute solution.—J. H. M.

gum, heated in a tube with cupric oxide in the usual manner. He declines to express an opinion as to the proximate constituents of the gum. I have referred to this portion of his experiments below, showing how near he was to the determination of its chief component. He sums up his opinion of its commercial value in the following words: "I infer that the African Sterculia tragacanth may be used both in pharmacy and in the arts, instead of the usual drug of Asia Minor."

AUSTRALIAN.

Bentham, "B. Fl.," 226, makes twelve species, divided into two sections, *Sterculia* and *Brachychiton*, Mueller, "Cens.," 15, erects these sections into distinct genera, adds a new species to each, and rejects *S. fœtida* as Australian.

Baron Mueller says (*teste* Blackett, *Chem. and Drug.*, Austral. ed., 1882, p. 100), "I have noticed gummous exudations from all the Brachychitons in Australia." The present writer has never heard of any from Australian species being described more fully than as being "like tragacanth."

S. diversifolia, G. Don, "B. Fl.," i, 229 (*Brachychiton populneum*, R. Br. in Muell. "Cens.," p. 15). Found in Victoria, New South Wales and Queensland. A "Kurrajong."

In the Clyde River district of New South Wales a correspondent of the writer came across a tree about 1 foot in diameter and 30 feet high. About a bucketful of gum was found at its foot, on the ground, naturally exuded and partly viscid. Enormous tears of the gum had flowed down the stem and were adherent to it.

I have received a quantity of gum of this species from Baron von Mueller. It cannot be distinguished, by any physical characteristic, from the Indian gums *S. urens* and *Cochlospermum Gossypium* already described. It only differs from the gum of *S. rupestris* (*infra*) in being in rounded tears, whereas the latter was much broken and splintered when received.

S. rupestris, Benth., "B. Fl.," i, 230 (*Brachychiton Delabechii*, F. v. M., in Muell. "Cens.," p. 15, *Syn. Delabechea rupestris*). Found in Queensland. A "Kurrajong." Called also "Bottle-tree" or "Gouty-stem."

Delabechia rupestris.—"When boiling water is poured over the shavings of this wood, a clear jelly, resembling tragacanth, is formed, and becomes a thick viscid mass; iodine stains it brown, but not a trace of starch is indicated" (Sir Thomas Mitchell's "Journal of an

Exped. into the Interior of Trop. Australia," etc., p. 155. These remarks are signed by J. L.—Dr. Lindley.

A specimen of the naturally exuded gum in the Technological Museum is remarkably like paraffin in appearance, and almost as free from color. It is rather tough and horny, and breaks with a dull fracture. In the mouth I fail (except in the shape of the pieces) to detect any difference between it and tragacanth. It is in irregular pieces, full of angles and points, the result of the fusion of innumerable tears.

A mass swells up readily in water and then disintegrates. The insoluble portion has a granular appearance similar to that which pearl-sago of exceeding fineness assumes under similar circumstances. The jelly is of snowy or rather icy whiteness, freer from color than the jelly yielded by the best isinglass, and of enormous bulk when the absorption of water is complete.

This gum and tragacanth present many points of difference. Their closest similarity is in outward appearance. *Sterculia* gum does not thicken water, except to a barely appreciable extent, and therefore could not have the economic uses to which the very viscid tragacanth is put. On treating the gums with cold water, a difference between them is the more bluish opalescent appearance of tragacanth, and the granular appearance of the mucilage afforded by *Sterculia*. But these gums may be at once distinguished by the canary-yellow color yielded by adding caustic soda to mucilage of tragacanth and boiling, no coloration being observable in the case of *Sterculia* gum.

The author then repeated the whole of Giraud's experiments on tragacanth, as detailed in *Phar. Journ.* [3], v, 766; viii, 773, and he may at once state that he obtained with tragacanth all the general results recorded by that chemist. He then repeated the experiments, with substitution of *Sterculia* gum for tragacanth, and he presents his results in the form of comparative statements:

Similarities—Qualitative.

1. Horny texture.
2. They swell enormously in water.
3. The jellies redden litmus.
4. They dissolve on prolonged boiling in a large quantity of water.
5. They dissolve on boiling in dilute hydrochloric acid.

Quantitative.

6. They contain about 20 per cent. of water.

Dissimilarities—Qualitative.

	Sterculia.	Tragacanth.
7. In cold water.	*a.* Colorless. *b.* Granular jelly. *c.* Adhesiveness absent or very small.	*a.* Opalescent. *b.* Smooth viscid mass. *c.* Adhesive.
8. Boiling in dilute alkali.	Insoluble.	Almost entirely dissolves.
9. Caustic soda and warming.	No change of color.	Canary-yellow color which fades on cooling.
10. Boiling in dilute acid.	Soluble, forming arabin [J. H. M.]	Soluble, forming pectin [Giraud].
11. Alcohol added to liquid formed in (10).	Whitish precipitate. (See fuller statement.)	Formation of floating glairy mass.

Quantitative.

	Sterculia.	Tragacanth.
12. Specific gravity.	*S. urens*, 1·49. *S. diversifolia*, 1·472.	1·384 [Watts' "Dict. and Encyc. Britt.").
13. Soluble gum.	Arabin (chiefly). *S. urens*, 3·14 p. c. *S. diversifolia*, 9·88 p. c. *S. rupestris*, 6·9 p. c.	"A mixture of different bodies, and not a definite principle, like arabin. 8-10° per cent. [Giraud]. 7·7 p. c. [J. H. M.].
14. Insoluble gum.	Pararabin. *S. rupestris*, 63·42 p. c. *S. diversifolia*, 61·74 p. c. *S. urens*, 75·1 p. c.	"Pectic compound." 60 p. c. [Giraud].
15. Starch.	None.	2·3 p. c. [Giraud].
16. Ash.	*S. rupestris*, 9·0 p. c. *S. diversifolia*, 8·195 p. c. *S. urens*, [1] 5·83 p. c. *S. tragacantha*, 7·8 p. c. [Fluckiger]. [1] The author finds 5·46 p. c. of ash in *Cochlospermum Gossypium*.	3 p. c. [Giraud]. 3-24 p. c. (mean of some experiments by J. H. M.) The author believes in the general accuracy of Giraud's figures, but the difficulties of making an accurate determination are enormous. This explains the fact that no two observers obtain the same figures.

Most Indian specimens of *S. urens* smell a little of acetic acid; tragacanth never does; as far as the author's experience goes.

The author is responsible for all the results in which names are not given in brackets.

EXPLANATORY NOTES ON SOME OF THE RESULTS RECORDED IN THE FOREGOING TABLES.

No. 14. "Some tragacanth was digested with fifty times its weight of water containing 1 per cent. of hydrochloric acid in a water-bath until dissolved; it was then filtered and excess of baryta water added. The precipitate, which formed slowly, was pectate of baryta. When of a suitable consistence, this was washed, suspended in water and treated with excess of hydrochloric or acetic acid, which left a precipitate of pure pectic acid. As the result of numerous determinations, it was found that by this method about 60 per cent. of pectic acid can be obtained from gum tragacanth" (*Pharm. Journ.* [3], v, 766; vii, 773). On repeating these experiments with tragacanth the results were as indicated by Giraud. After some little time there was formed, on addition of baryta water in excess, a whitish or opalescent precipitate of pectate of baryta, very similar in appearance to weak mucilage of tragacanth. The precipitation was complete in forty-eight hours. Sterculia gum substituted for tragacanth gave negative results.

No. 11. Addition of alcohol to dilute acidulous solution.

Sterculia.—The liquid becomes cloudy throughout its whole bulk, behaving in much the same way that a weak solution of arabin would if similarly treated. It is, in fact, found to be arabin.

Tragacanth.—A glairy substance is formed, the transparency of the liquid being scarcely impaired. On standing this jelly-like body rises to the top of the liquid. This is pectin, according to Giraud.

TABLE SHOWING THE AVERAGE COMPOSITION OF STERCULIA GUM.

	Rupestris.	Diversifolia.	Urens.
Soluble in cold water (chiefly arabin)..	6·9	9·88	3·14
Parabin.....	63·42	61·74	75·1
Moisture.....	20·52	20 2	16·6
Ash.....	9·015	8·195	5·83
	99·855	100·015	100·67

The author's discovery of pararabin in *Sterculia* gum really confirms Flückiger's figures obtained by combustion of the gum of *S. Tragacantha* (*Pharm. Journ.* [2], x, 642). His percentage results are practically identical with the generally accepted figures for arabin,

ergo, for pararabin, and his experiments are additional evidence to show the general similarity of *Sterculia* gums. The adhesiveness of that of *S. Tragacantha* is very remarkable, and further information on the subject is desirable. It would be particularly interesting to know the percentage of arabin.

Pararabin, like metarabin, is of course a modification of arabin. While metarabin is converted into arabin by treatment with dilute *alkali*, pararabin is similarly converted by treatment with dilute *acid*. They both are insoluble, but swell up in cold water. A solution of pararabin in weak acid is precipitated by alkalis.

Pararabin is usually obtained from beet or carrot pulp. It constitutes the Chinese vegetable jelly (agai-agai), or Ceylon moss (*Gracilaria*), according to Reichardt (Watts' "Dict.," 3d Supp., Pt. 1, p. 119; Roscoe and Schorlemmer, iii, 2, 571). The present writer took a sample of agar-agar, together with a *Gracilaria* found in Australian waters, and a sample of the Japanese "kanten," said to be obtained from a sea-weed (*Gelidium corneum*). He found them all to consist *mainly* of pararabin, but, unlike *Sterculia* gums, and like tragacanth, he found that caustic alkali produced a canary-yellow color when boiled with them. He also observed (and in this respect these substances differ from both *Sterculia* gum and tragacanth) that when baric hydrate is added in the cold to a solution in weak hydrochloric acid, a canary-yellow color was produced on standing for a few hours. He has not pursued the subject further in this paper, as being, to some extent, a digression.

RATE OF DECOMPOSITION OF CHLORINE-WATER BY LIGHT.[1]

By Dr. G. Gore, F. R. S.

In this research, the author has investigated, by means of the voltaic balance, the kind and amount of chemical change, the rate at which decomposition proceeds, and the chemical composition of the products formed at all stages of decomposition of chlorine-water when exposed to daylight and sunlight in colorless glass vessels.

The chlorine-water, by exposure to diffused daylight, was decomposed with moderate uniformity, but at a gradually diminishing rate,

[1] Abstract from a paper read before the Royal Society; reprinted from *Chemical News*, Dec. 6, 1889, p. 271.

as shown by the losses of voltaic energy, until no further loss of such energy occurred; the liquid then consisted of an aqueous solution of hydrochloric acid, hydrochlorous acid, and chloric acid. By further exposure of the liquid to daylight and sunlight during several weeks, peroxide of hydrogen was formed, and the amount of hydrochloric acid and voltaic energy very slowly increased until that of the latter became equal to that of dilute hydrochloric acid of equivalent strength to the whole of the chlorine present; all the other chief properties of the final liquid agreed with those of a mixture of dilute hydrochloric acid and peroxide of hydrogen. Still further exposure to strong sunlight caused no further change in chemical composition, amount of voltaic energy, or other property of the liquid.

This research shows distinctly that the decomposition of chlorine-water by light may be divided into two essentially different parts, or periods, of chemical change, and that the kinds of chemical change occurring during these two periods are largely different. During the first period, a very great and gradual *loss* of voltaic energy occurs, attended by formation of hydrochloric, hydrochlorous, and chloric acids. During the second period, a moderate and very slow *increase* of voltaic energy takes place, accompanied by decomposition of the hydrochlorous and chloric acids; a further formation of hydrochloric acid, and the production of peroxide of hydrogen. Under the influence of prolonged sunlight, the whole of the oxygen of the hydrochlorous and chloric acids united with water to form peroxide of hydrogen, and the peroxide then combined with the whole of the hydrochloric acid to form a definite "solution compound," represented by the formula $2HCl.H_2O_2$.

The chemical composition of the products of the change at the end of the first and second periods were ascertained by means of the voltaic balance and ordinary chemical analysis. During the first period, forty consecutive measurements of the voltaic energy, at stated intervals of time, were made, and the energy diminished from about 1,219 millions to 2·9 millions; and during the second period eight such measurements were made, and the energy increased to 9·3 millions. A curve is given showing the rate of loss of energy during the first period.

It is interesting to observe that suitably decomposed chlorine-water, or possibly, in its stead, a mixture of—

$$6HCl+HClO+HClO_3$$

in a proper proportion of water, has the property of absorbing energy by exposure to light, very much like that possessed by the green leaves of plants.

ON THE ANTISEPTIC VALUE OF CHEMICAL PREPARATIONS, WITH SPECIAL REFERENCE TO SOME OF THE SALTS OF MERCURY.[1]

By Dr. Behring.

Last year there was a good deal of writing and disputing about the value of antiseptics, especially of iodoform, carbolic acid, preparations of mercury, and creolin. With regard to iodoform, the dispute was keenest. Surgeons had used it profusely, with the best results, and maintained vigorously that, practically, it was a valuable antiseptic, whilst, on the other hand, some experimenters, bringing it into close contact with the germs, made out that it had actually no powers as a germicide. Both sides, as was natural to suppose, were partly in the right; those were, however, most in the right who had practically proved its value. Iodoform, it seems, acts as a disinfectant only when it is being decomposed. In discharging wounds, *especially when the discharge is foul,* the iodoform gets slowly broken up into iodine and hydrogen, and these change stinking pus into scentless, diminish the amount of secretion, and limit the growth of the bacteria that cause it. It is, however, a mistake to think that any fluid coming from a wound will have this effect; the reducing powers of the living germs are necessary; that which causes a wound to foul is what breaks up the iodoform. The iodoform thus resembles a good waiter, it acts only when its services are required.

Germs with but slight decomposing power, such as charbon germs, suffer but little from iodoform, because they cannot decompose it sufficiently quickly to destroy themselves in the process by releasing the iodine. On the other hand, the comma bacilli of Asiatic cholera decompose iodoform quickly, and the result is that these germs are not only hindered in their growth, but killed, and that quickly. All the *anaerobia* Dr. Behring has investigated. *e. g.*, the bacilli of tetanus and of malignant œdema, are strong decomposers, and hence controlled by iodoform. Two years ago he showed that the addition

[1] *Deutsche medicinische Wochenschrift,* Oct. 10, 1889; transtrated and abstracted by W. A. Stewart; reprinted from the *Medical Chronicle,* December.

of iodoform checked the growth of tubercle bacilli in blood serum, but as the growth of these bacilli is but slow, he cannot, as yet, decide whether in this case also the result is due to the reducing power of the germs.

As a rule, the more a bacteria culture stinks, the more certainty is there that the germs are rapid decomposers, and that iodoform will check their growth. Thus, it is not on the staphylococcus of laudable pus that iodoform acts to any great extent, but on the germs that in stinking pus we find alongside the staphylococci.

It has been held that iodoform acts on the ptomaïnes, but to this theory Behring is opposed. Iodoform acts before the ptomaïnes are produced, and besides, these very ptomaïnes of themselves *hinder* the development of pus.

Carbolic acid, once the sovereign antiseptic, naturally led us to think that iodoform would behave in a similar fashion, and hence the mistakes. As a disinfectant, carbolic acids have the advantage of acting almost equally well in checking in almost all circumstances the growth of germs. In the presence or absence of albumen, in acids or alkalies, against aërobic or anaërobic bacteria, carbolic acid acts almost equally powerfully. This is due likely to its molecule, difficult to break up, and very prone to piece itself together again. In oils and in alcoholic and resinous substances it is inert, but, as in wound discharges, etc., it quits these and slips into the water of the discharge, it is practically active, although in these media.

Perchloride of mercury, used by Bergman (1878) for impregnating dressings, and described and praised by R. Koch (1881) as the strongest and best antiseptic, did not in practice come up to the exact figures given by Koch, and the reproach thrown out was that "the human body was no test tube." Koch's experiments regarded the antiseptic value of the perchloride as tested by its action on the germs in broths and gelatin. It was next discovered that the perchloride varied in its action in albuminous and non-albuminous media, in concentrated and weak solutions and at different temperatures. It might have been discovered also, adds Behring, that albuminous media, in which bacteria are already developed, have the property of reducing the perchloride of mercury to calomel, and even to metallic quicksilver. Of course the antiseptic action is gone. Here we have an antiseptic differing entirely from iodoform in its method of action. After these general remarks, our author gives in long detail the results of his numerous elaborate

experiments on the mercury salts and other antiseptics. It is impossible to give these in small compass. The accompanying tables give his chief results:

TABLE I.

PREPARATIONS OF MERCURY.

0 1 per cent. Solutions in distilled water.	I. Stoppage of developm'nt reckoned by $HgKI_2$.	II. Stoppage of developmn't reckoned by Hg.
1. Merc. Chl. $HgCl_2$	1 : 10,000	1 : 13,300
2. 1 Merc. Chl. + 10 Sod. Chlor. $HgCl_2 + 10NaCl$	1 : 15,000	1 : 20,000
3. 1 Merc. Chl. + 3 Sal Ammon. $HgCl_2 + 3\ NH_4Cl$	1 : 12,000	1 : 16,000
4. 1 Merc. Chl. + ½ Pot. Cyan. $HgCl_2 + \frac{1}{2}KCy$	1 : 12,000	1 : 16,000
5. 1 Merc. Chl. + 1 Pot. Cyan. $HgCl_2 + KCy$	1 : 15,000	1 : 20,000
6. 1 Merc. Chl. + 2 Pot. Cyan. $HgCl_2 + 2\ KCy$	1 : 18,000	1 : 24,000
7. 1 Merc. Chl. + 5 Tartaric Acid (Laplace's solution) $HgCl_2 + C_4H_6O_6$	1 : 8,000	1 : 11,000
8. Merc. Cyanid $HgCy_2$	1 : 18,000	1 : 24,000
9. Merc. Cyanid and Pot. (E. Merck's crystallized solution) $HgCy_2\ (KCy)_2$	1 ; 24,000 (1 : 20,000)	1 : 32,000
10. Merc. Oxycyanide (prepared by Kahlbaum) $HgO\ HgCy_1$	1 ; 16,000	1 : 20,000
11. Merc. and Pot. Iod. (Nessler's Reagent) $HgI_2\ 2KI$	1 : 20,000	1 : 25,000
12. Merc. Formamide (Lieberich's solution) HgO dissolved in a watery solution of Formamide	1 : 10,000	1 ; 13,000
13. 1 Merc. Sozoiodol (prepared by Trommsdorff) +2 Sod. Chl.	(1 : 6,000	1 : 18,000
14. 1 Merc. Sozoiodol + 3 Pot. Iod	(1 : 10,000)	1 : 30,000

TABLE II.

Stoppage development.	
Over 1 : 40,000	Cyanine; malachite green.
Over 1 : 30,000	Silver iodide, chloride and cyanide, dissolved in potassium cyanide; silver nitrate.
Over 1 : 25,000	Saffranin.
Over 1 : 20,000	Mercuric cyanide.
Over 1 : 10,000	Mercury preparation of Table I; gold preparations (?); fluoride of antimony and sodium.
Over 1 : 1,500	Iodine trichloride; saturated solution of soda; platinic cyanide of potassium; hydroxylaminic acid; cadaverine.
Over 1 : 500	Quinine; turpentine; zinc iodide; piperidine; acid quinine sulphate; carbolic acid; iodo iodide of potassium.
Over 1 : 250	Oxalic acid; kreasote and thymol from alcoholic solutions.
Over 1 : 150	Urethane; paraldehyde; chloral hydrate; sodium salicylate; eucalyptus oil; potassium carbonate; potassium bicarbonate; kreolin (Pearson).
Under 1 : 100	Sodium iodide; kreolin (Artmann); ether.
1 : 15	Alcohol.

NOTE ON NARCEINE.

By P. C. Plugge, Ph. D., M. D., of Groningen, Netherlands.

Dott's paper on "Narceine and Its Salts,"[1] has directed my attention to an earlier paper of Merck's on "Chemically Pure Narceine."[2] Merck, after describing some experiments concludes: "This behavior stands in contradiction to the assumption hitherto current that narceine is a very weak base," and farther on: "chemically pure narceine, contrary to previous statements, possesses a faintly alkaline reaction." Being convinced of the correctness of both rejected assumptions, I feel obliged to defend my opinion, which is more in harmony with Dott's.

To Dott's remark "that Merck, like many other German chemists, ignores the work done by English and French chemists," I can add, that Merck seems to be equally ignorant of the work done by a Dutch chemist, even after the publication of the results of his work in a wide-spread German journal. However, my paper on opium alkaloids seems also to be unknown to Mr. Dott. Otherwise this author would probably have strengthened his refutation of Merck's conclusions in respect to the strength of the base narceine with some of the results of my investigations on opium alkaloids.

I entirely agree with Dott that the tendency to form basic salts is no proof of strength; and in my opinion the somewhat strange experiment of Merck with narceine, moistened with acetic acid, etc., is of no value in settling this question.

Beferring for further particulars to my circumstantial exposition in the *Archiv der Pharmacie*,[3] I will here shortly repeat the data on the strength of which I have divided the opium alkaloids into strong and weak bases, and have classed the narceine with the last-named group.

I. Differing from all other alkaloids, also from morphine, codeine and thebaine, the three weak opium bases, narcotine, papaverine, and narceine, have no blue-coloring action upon a solution of red litmus, nor any power of neutralizing acids. Therefore, the acid in the solutions of salts of those alkaloids can be estimated with alkali-lye and litmus tincture, as well as in solutions of free acids.

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[1] *Pharm. Journ.* [3], xx, 335 (Oct. 26, 1889).

[2] *Ibid* [3], xix, 1035 (June 22, 1889).

[3] *Archiv d. Pharmacie*, xxiv (1886), 903; xxv (1887), 45, 49, 421, 793 and 805.

This is demonstrated by the following experiments :—

A. Experiments with $\frac{1}{100}$ Normal Solutions.

1. Forty cc. diluted hydrochloric acid are neutralized by 41·7 cc. NaOH solution.

2. Forty cc. diluted hydrochloric acid, after saturation with *narcotine*, are neutralized by 41·5 cc. NaOH solution.

3. Forty cc. diluted hydrochloric acid, after saturation with *papaverine*, are neutralized by 42·2 cc. NaOH solution.

4. Forty cc. diluted hydrochloric acid, after saturation with *narceine*, are neutralized by 42·0 cc. NaOH solution.

B. Experiments with $\frac{1}{10}$ Normal Solution.

5. Ten cc. diluted sulphuric acid are neutralized by 9·65 cc. NaOH solution.

6. Ten cc. diluted sulphuric acid, after dissolving 268 mgrm. *narcotine*, are neutralized by 9·65 cc. NaOH solution.

7. Ten cc. diluted sulphuric acid, after dissolving 300 mgrm. *papaverine*, are neutralized by 9·7 cc. NaOH solution.

8. Ten cc. diluted sulphuric acid, after dissolving 300 mgrm. *narceine*, are neutralized by 9·7 cc. NaOH solution.

C. Experiments with other Alkaloids and $\frac{1}{10}$ Normal Solutions.

9. Ten cc. diluted sulphuric acid are neutralized by 9·65 c.c. NaOH solution.

10. Ten cc. diluted sulphuric acid, after dissolving 250 mgrm. *morphine*, are neutralized by 1·7 cc. NaOH solution.

11. Ten cc. diluted sulphuric acid, after dissolving 299 mgrm. *codeine*, are neutralized by 0·6 cc. NaOH solution.

12. Ten cc. diluted sulphuric acid, after dissolving 308 mgrm. *cinchonine*, are neutralized by 4·6 cc. NaOH solution.

13. Ten cc. diluted sulphuric acid, after dissolving 300 mgrm. *chinine*, are neutralized by 6·0 cc. NaOH solution.

14. Ten cc. diluted sulphuric acid, after dissolving 200 mgrm. *strychnine*, are neutralized by 3·9 cc. NaOH solution.

While the weak bases possess no neutralizing power at all, the alkaloids named *sub.* C. neutralize a corresponding part of the strong acid, as well as the NaOH solution.

Morphine.—$C_{17}H_{23}NO_3 + H_2O = 303$, consequently 250 mgrm. morphine = 7·69 cc. NaOH solution. Therefore in experiment 10 C. I must have a quantity of uncombined acid corresponding with 1·69 cc. NaOH solution ; really 1·7 cc. more used.

In a second series of experiments a fixed quantity of the alkaloid salt, with a definite quantity of acid, was dissolved in water; this solution being colored by litmus tincture, NaOH solution was added until a distinct blue color had appeared. From the quantity of NaOH solution (9·65 cc. = 0·0365 gram HCl) the amount of acid was calculated. While the weak opium-bases have no neutralizing power on acids, and no influence on the color of litmus, the quantity of acid found by titration with NaOH must be the same as that calculated from the formula.

1. *Hydrochlorate of narcotine* containing 7·718 per. cent HCl.

Taken 400 mgrm. with 30·87 mgrm. HCl, dissolved in about 30 cc. water. This solution needed for neutralization 8·4 cc. soda solution = 30·66 mgrm. HCl.

2. *Hydrochlorate of narceine* containing 6·9076 per cent. HCl.

Taken 368 mgrm. with 25·32 mgrm. HCl, dissolved in 50 cc. water ; used 6·8 cc. soda solution = 25·72 mgrm. HCl.

3. *Hydrochlorate of papaverine* containing 9·809 per cent. HCl.

Taken 400 mgrm. with 39·24 mgrm. HCl. Used 10·4 cc. soda solution = 39·34 mgrm. HCl.

All other alkaloids show very different results. Out of several experiments I will quote here only one :

4. *Nitrate of strychnine* containing 15·87 per cent. HNO_3.

Taken 326 mgrm. with 51·73 mgrm. HNO_3, dissolved in 40 cc. water. While this quantity of uncombined nitric acid would require nearly 8 cc. of the soda solution, in the proof the first drop of the natron-lye already caused a deep blue color.

II. Another ground for my division of opium bases into *strong* and *weak* ones is the phenomena shown by its salts with respect to the alkali salts of organic acids.

The strong bases (morphine, codeine and thebaine) are not precipitated by the solutions of the alkali salts of organic acids (acetates, oxalates, tartrates, benzoates, etc.), but from the solutions of narcotine, papaverine and narceine salts the pure alkaloid is precipitated, while these weak bases (R) do not combine with the weak acid :

$$RHCl + CH_3COONa = NaCl + CH_2COOH + R.$$

III. The weak bases, narcotine, papaverine and narceine, are also precipitated from the solutions of their salts by the solutions of pure $NaHCO_2$, while the strong bases, morphine and codeine, remain in the solutions.

IV. Treated in solution with alkali chromates, ferro- and ferricyanides of potash, narceine appears to belong to the weak opium alkaloids.

The fact that narcotine, papaverine and narceine can be separated from the acid as well as from the alkaline solution, by shaking these solutions with benzol, chloroform. etc., after the method of Dragendorff, while the three other opium alkaloids, morphine, codeine and thebaine, can be isolated only by shaking the alkaline solution, places narceine in the group of weak bases.

Concerning the adulteration of commercial narceine maintained by Laborde, I, in accordance with Mr. Dott, think it highly improbable that narceine would be sent out so contaminated, even with the opium alkaloids, morphine and codeine, most widely differing from narceine.

Moreover, several experiments on animals with the different opium bases make it very difficult for me to understand how the activity of the alkaloid could be weakened by the presence of morphine and codeine.

To conclude, I am of opinion that both Merck's impugning the generally acknowledged weakness of narceine and Laborde's assertion concerning the impurity and consequent inconstant therapeutical action of this alkaloid are not founded in truth.

The commercial hydrochlorate of narceine I used for my experiments was procured from E. Merck in Darmstadt in 1886. A careful investigation showed me that this salt was pure. After combustion the platinum double salt gave 14·548 per cent. Pt, while the formula $(C_{23}H_{29}NO_9,HCl)_2PtCl_4$ contains 14·563 per cent. Pt, and Hesse found 14·52 per cent. Pt. An adulteration with morphine or codeine, whose platinum double salts contain 19·966 resp. 19·048 per cent. Pt, would, therefore, have been highly perceptible by largely influencing the residual quantity of platinum.—*Phar. Jour. and Trans.*, Nov. 23, 1889, p. 401.

EFFECTS OF CODEINE.[1]

By Dr. G. Rheiner.

Dr. Rheiner briefly records the therapeutic effects of codeine in thirty-five patients, varying in age from a few weeks to seventy-five

[1] *Therapeutische Monatshefte*, September and October, 1889; abstracted by D. J. Leech; reprinted from *The Medical Chronicle*, December.

years. The majority of these suffered from bronchitis or broncho-pneumonia, six were under treatment for whooping-cough; the remainder were affected with cardiac dyspnœa, asthma, or phthisis. His experience leads him to advocate the use of codeine where a milder narcotic than morphia is wished; and although he thinks that morphia in suitable doses may be given with safety to the youngest children, he looks upon codeine as less dangerous. From relatively large doses, as for example $\frac{1}{70}$ of a grain daily to a child nine months old, he finds no unpleasant effects, and 2 grains daily were quite harmless in adults. He holds that codeine has the advantage over morphia in not causing anorexia. It seems in some cases to increase appetite, probably by its beneficial influence in removing discomfort. Whilst relieving irritation it does not cause sickness or catarrh, and slight dizziness and moderate headache in one or two cases were the only troubles noticed after its use. It may produce its effects in half an hour or not for several hours.

He finds codeine most useful in the bronchitis of children, and adults with no fever or with but slight rise of temperature. Where there is much fever, rapid breathing, etc., it gives little relief. In a case of "pseudo-croup" he found it without benefit, but morphia also failed to soothe. In phthisis codeine had a very beneficial effect, sound sleep following its use; the appetite increased, while the cough became somewhat looser. When Dover's powder replaced the codeine the same relief followed, but the appetite was decreased. In an anæmic individual and in a case of chronic bronchitis Dover's powder caused vomiting, codeine did not. Codeine was found quite useless in an early stage of phthisis, but a Dover's powder also was of no service. Here morphia in $\frac{1}{2}$ to $\frac{3}{5}$ of a grain daily quieted the irritating cough without producing unpleasant effects or sleep. In a case of asthma codeine was completely useless, whilst chloral hydrate given on successive nights seemed to prevent the attacks. In phthisis or heart affections the only effect of codeine was to relieve cough, but it was without injurious effect on the circulation. Out of five cases of whooping-cough in which codeine was tried it was completely useless in four.

The doses of codeine given by Rheiner were small; $\frac{1}{140}$ to $\frac{1}{70}$ of a grain in infants under one year, and from the $\frac{1}{40}$ to $\frac{1}{30}$ of a grain up to five years, whilst to adults from $\frac{1}{3}$ to $\frac{1}{2}$ a grain. On the whole, the observations do not help much in the estimation of the relative

influence of morphia and codeia. Fraser (*British Medical Journal*, Jan. 29, 1889) has given some grounds for believing that the replacement of an equivalent of hydrogen in the hydroxyl group of morphia by methyl (by which codeine is produced from morphia) has simply the effect of weakening physiological action, no special attribute being found in the new compound.

He looks on codeine, therefore, as simply a weak morphia, and the observations of Bruce point in the same direction. Unfortunately Dr. Rheiner, whilst well acquainted with the German and French literature connected with codeine, has failed to acquaint himself with the more recent work done in England, and hence his observations do not throw much further light on a question which is of such great importance both to pharmacologists and therapeutists.

CASTOR OIL ADULTERATION.[1]

By Michael Conroy, F. C. S.

It would be difficult to name a business where the art of adulteration is practiced to the extent that it is in the oil trade. Castor oil, however, is one of the oils that is less subject to adulteration than perhaps any other that is imported, but there has recently been received in Liverpool from Calcutta more than one shipment, numbering several hundred cases bearing the usual marks, which has been found on examination to be adulterated with cocoanut oil to the extent of from 20 to 30 per cent.

Castor oil, owing to scarcity of seed, has recently advanced over 50 per cent. in value, and it is no doubt due to this cause that we find this somewhat novel sophistication. The choice of a substance like cocoanut oil seems very absurd, but we should remember that at the temperature of the Indian climate this oil would be quite liquid, and the fact that it would become solid on its arrival in England would probably not present itself to the native mind. It is this characteristic that first drew attention to the matter, for it was found that this particular lot of castor oil began to become semi-solid on standing a few days after landing.

As it is possible that some of this adulterated oil may find its

[1] Read at a meeting of the Liverpool Chemists' Association, November 7, 1889; reprinted from *Phar. Jour. and Trans.*, November 16, p. 385.

way into pharmacy, I have thought it worth while to bring these facts forward, and to give the results of my experience as to the best means of detecting and estimating the adulterant.

The test given in the British Pharmacopœia is that it is "entirely soluble in one volume of absolute alcohol and in two volumes of rectified spirit." Now this test is quite useless for the detection of cocoanut oil or any other possible adulterant, because oils that are insoluble in both absolute alcohol and rectified spirit are soluble in a mixture of either with castor oil, and I have prepared samples of castor oil containing 10 to 20 per cent. of cocoanut oil which are as freely soluble in these solvents as is castor oil itself. On the other hand, I have never yet met with a sample of castor oil, one volume of which would dissolve in two volumes of rectified spirit of the Pharmacopœia strength, viz., specific gravity ·838 at 60° F. With the thermometer at 70° to 80° F., solution does take place, but not at 60° F. With spirit of specific gravity ·830, one volume of castor oil dissolves perfectly in two volumes at 60° F., so that it will be seen that by either increasing the temperature, or by using spirit a few degrees stronger, solution does take place; but even with this alteration the test will only serve, as has already been shown, to detect adulterants outside of certain limits. Castor oil is also soluble in glacial acetic acid, while all other fixed oils, with the exception of croton oil, are insoluble. This test is given in some works, but I find the same objection to it that I have previously mentioned in connection with the Pharmacopœia test, for notwithstanding the fact that other oils *per se* are insoluble, they are rendered soluble when mixed with castor oil within certain limits.

The chief distinguishing features of castor oil are undoubtedly its high density and its insolubility in petroleum ether (benzolene) when compared with other fixed oils. We find it stated in text books that castor oil is insoluble in petroleum ether, of which, however, it has the peculiarity of dissolving its own volume. This statement is not correct, for I shall show you that castor oil is to a certain extent soluble; also, that under a certain temperature castor oil will not dissolve its own volume of petroleum ether.

This latter feature, I find, affords trustworthy proof of the presence or absence of any other fixed oils.

The following experiment was made with samples of East Indian, French and Italian castor oil, each giving practically the same result.

The petroleum ether used had a specific gravity of ·7033 at 60° F.

Twenty cc. each of castor oil and petroleum ether were mixed by brisk agitation in a tall graduated tube and maintained at a temperature of 60° F.

The mixture never became clear, and on standing for about an hour, a layer of petroleum ether collected on the surface measuring 3 cc. This, as we shall shortly see, has a very important bearing, and it should be borne in mind that the same experiment was tried on many samples from various sources, and that never in any instance at a temperature of 60° F. did a clear mixture result, and in all cases, a separation of petroleum ether took place on standing, amounting to practically the same volume. If on the other hand the mixture be made at a temperature of 70° F. the whole of the ether is dissolved, or if the mixture made at 60° F. be shaken and raised to 70° F. perfect solution takes place, but on cooling again to 60° F. the same amount of separation occurs.

Thus far we have seen the behavior of petroleum ether with genuine castor oil, and we shall now see how it behaves with adulterated samples. For this purpose samples were made each containing 5 per cent. of one fixed oil, such as cotton-seed, cocoanut, etc.

These samples *in all cases* made a perfectly clear solution with an equal volume of petroleum ether at 60° F., and in no instance did any separation take place on standing.

We thus see that so small an amount as 5 per cent. of a fixed oil, other than castor oil, when present is sufficient to cause the whole of the petroleum ether to combine and form a perfectly clear solution, and I think that it has clearly been shown that the test is a reliable and a safe one.

So far I have only made use of this as a qualitative test, but I have hopes that by adopting certain precautions it can be made a quantitative one, for I find that if two volumes of petroleum ether be used instead of one, and thoroughly mixed by agitation at a temperature of 60° F., separation takes place in the adulterated as well as in the pure samples, and that the volume of the ethereal layer increases with the amount of adulterant present with a corresponding diminution in the lower castor oil layer.

To demonstrate this I have here three tall, graduated tubes of 60 cc. capacity.

No. 1 contains 20 cc. of pure castor oil and 40 cc. of petroleum ether.

No. 2.—20 cc. of castor oil containing 10 per cent. of cocoanut oil and 40 cc. of petroleum ether.

No. 3.—20 cc. of castor oil containing 20 per cent of cocoanut oil and 40 cc. of petroleum ether.

These, on being well mixed by agitation and allowed to rest, separate into portions varying with the amount of cocoanut oil present in the samples, as shown in the following table :—

	Bottom or castor oil layer.	Petroleum ether layer.	Total measurement.
No. 1	36 cc.	24 cc.	60 cc.
No. 2	33½ "	26½ "	60 "
No. 3	30½ "	29½ "	60 "

I have already referred to the statement found in text-books to the effect that castor oil is insoluble in petroleum ether, and promised to demonstrate that such was not the case. No. 1 sample proves my contention, for I have already shown that in mixing 20 cc. each of castor oil and petroleum ether, 37 cc. of the castor oil mixture separates, whilst in this last experiment (No. 1 in table) only 36 cc. of the castor oil mixture is left, showing that the extra 20 cc. of petroleum ether has taken up some of the castor oil, and the decrease in Nos. 2 and 3 is undoubtedly due to the fact that the cocoanut oil is dissolved out by the petroleum ether. This can be demonstrated by drawing off the upper layer and driving off the petroleum ether, when the cocoanut oil containing some castor oil will be left.

It must be remembered in reading this table that the lower stratum is a mixture of castor oil and petroleum ether in nearly equal portions, and that the diminution in bulk in Nos. 2 and 3 is due not only to the abstraction of the cocoanut oil by the petroleum ether, but also to the fact that there is that much less castor oil in the sample to combine with the ether, so that the lower portion will show a decrease in volume from these two causes and the upper one a corresponding increase.

I have not tried this experiment with a sample containing more than 20 per cent. of cocoanut oil, because with this percentage of adulteration the separation of the two layers is very slow. This is due to the peculiar solvent action already referred to in connection

with the alcohol test, where a solvent has the power, in combination with a substance which it freely dissolves, to take up a third substance which, without the aid of the second, it could not dissolve. Therefore a sample containing much more than 20 per cent. of cocoanut oil or other adulterant would in conjunction with the petroleum ether carry the castor oil into solution.

As a quantitative test, my experience of this method is only of a few days' standing and I do not wish to speak too dogmatically upon it, but I do think that if carefully carried out at a temperature of 60° F. it is capable of yielding very trustworthy results.

I have alluded to the high density of castor oil as being one of its distinctive characteristics, and in this instance, where the adulterant is cocoanut oil, it is possible to arrive at the percentage of adulterant present by the specific gravity process quite as accurately as by either the saponification equivalent or the iodine absorption test, and with far greater facility.

The specific gravity of castor oil at a temperature of 60° F. is ·964. I have never found any higher, and the lowest that I have met with was a sample of French oil which gave ·9625 at the same temperature. There is a greater range than this given in text books, but I much doubt their accuracy, and in my experience ·963 to ·964 is the correct density for genuine oil. When castor oil is adulterated with 10 per cent. and over of cocoanut oil, the latter separates when the temperature falls to 60° F., and it becomes necessary in such cases to take the density at a higher temperature. I have therefore taken a sample of castor oil possessing a density of ·964 at 60° F. and found its density to be ·949 at 100° F. A sample of cocoanut oil at the same temperature (100° F.) I found to be ·912. Both densities were taken by means of an accurate 1,000 grain bottle. From this it will be seen that the difference between the two densities is sufficient to enable one to arrive at a very accurate estimation, by a very simple calculation, of the amount of cocoanut oil present.

In the first place it is of course necessary to ascertain the presence of cocoanut oil, and this can be done by heating the sample under examination in a small porcelain dish, when the distinctive odor of cocoanut oil can be readily ascertained. By this plan the presence of even 1 per cent. can be detected, and 5 per cent. is quite distinctive to anyone possesring an ordinary sense of smell.

I have heard within the last few days that some castor oil has

reached Glasgow, which, on examination, was found to be adulterated with cotton-seed oil.

The adulterant is probably what is known as "blown" cotton-seed oil, which is made by blowing warm air through the oil. Great heat is thereby developed, and the oil increases in density and viscosity.

The presence of this oil can be detected by my modification of the nitrate of silver test, which is applied as follows:—

1. Make a test solution containing five parts of silver nitrate and one part of nitric acid (specific gravity 1·42) in one hundred parts of rectified spirit (specific gravity ·838).

2. Pour about 100 grains of the oil under examination into a dry test tube, about half-an-inch in diameter, add to it 10 grain measures of the above test solution, and place the tube in *boiling* water for five minutes.

Castor oil assumes a pale yellow color, but the presence of cotton-seed oil causes it to become deep red.

In conclusion, I would just add that the quantitative petroleum ether test is capable of much further development, but being tied for time I have not had an opportunity of fully working it out.

ESSENCE OF SENNA PODS.[1]

By C. Symes, Ph.D.

Nowadays, when, like the Athenians of old, we are constantly looking for something new, it is rather gratifying to recognize the reintroduction of a drug which can claim antiquity as one of its virtues. Not only were senna pods known, but for their properties were recognized, a century or two ago; but as far as I can gather they have not been popular at any period until quite lately.

Dr. Keith, after giving them an extended trial, recommended them to Dr. Macfarlan, who, on gaining experience of their utility as an aperient, contributed a note on the subject which was published in the *Lancet* of July 27 last. Soon after this a parcel which had lain on our shelves undisturbed for nearly twelve months was brought into use on a few ounces of a concentrated infusion being applied for. This

[1] Read at a meeting of the Liverpool Chemists' Association held on November 7, 1889. Reprinted from the *Chemist and Druggist*, November 9, 1889.

small quantity was prepared by the evaporation of an infusion in the way mentioned subsequently by Mr. E. H. Salmon in the *Pharmaceutical Journal* of October 12, p. 281 (AM. JOUR. PHAR., Nov., p. 581). This produced a dark liquid possessing scarcely any odor or taste, and in no way reminded me of its relation to senna leaves. I should perhaps have agreed with Mr. Salmon that it was tasteless; but recently a customer mentioned that after taking "tasteless castor oil," "tastless cod-liver oil," and "tasteless cascara sagrada," he had come to the conclusion that a chemist's notion of the meaning of "tasteless" was a rather extraordinary one, and differed widely from that of the public generally. This was fairly efficient as an aperient, but as it scarcely came up to expectations a larger quantity was prepared, to meet a growing demand, in what I regard as a more rational manner. Mr. Groves long since determined that the activity of senna leaves depended on the presence of a compound of cathartic acid with calcium and magnesium, and that this was injured by continued heating. The active agent being cathartin in senna pods also, it was evident that to obtain the best results extraction by pressure, as advocated by Mr. E. W. Bell in *The Chemist and Druggist*, October 6, p. 609, must be adopted. Mr. Bell's proposal is in fact all that can be desired, but experience on several batches convinces me that he does not completely exhaust the leaves, and that the resultant fluid extract is not a true valoid.

In other words, the sixteen ounces of finished essence does not, in my experience, fully represent the activity of the pound of pods operated on. No doubt the evaporation method tends to produce the more nearly tasteless preparation, but this will depend to some extent on whether the pods are old and brown or new and green. Nearly all the supply at present is fairly old, for the demand until recently has been exceedingly small; but that it has grown considerably will be evident from the fact that the stock offering on the London market, October 10, was from fifteen to twenty bales, whereas a fortnight later, as far as could be ascertained, this had all been bought up, and there was not a bale remaining in first hands. If the pods have been all well preserved they contain a small quantity of oleo-resin and wax, which is readily extracted by ether (as sample now shown). Dr. James wrote in 1752: "The fruit or follicles of the senna tree are less active than the leaves," and this is supported by some opinions at the present day; but Mr. Salmon found those he examined to contain

two and one-half per cent. of cathartin as compared with two per cent. only in the leaves. But he does not say if this substance was purified further than by precipitation with alcohol; if not, it may contain some little mucilaginous and albuminous matter. Two samples of pods examined by myself contained 0·72 and 0·8 per cent. of pure cathartic acid, obtained by precipitating a fluid extract with an equal bulk of absolute alcohol; the liquid filtered from the precipitated mucilage and salts was mixed with more absolute alcohol, as long as a precipitate was produced. This precipitate was washed with alcohol, dissolved in a little water, freed from albumen by a few drops of hydrochloric acid, and the filtrate completely precipitated by the addition of more hydrochloric acid; the impure cathartic acid thus obtained was purified by dissolving in 60 per cent. alcohol and precipitating by ether. My object has not been to make an exhaustive inquiry into the relative merits of senna leaves and pods, but to propound on a knowledge of the foregoing what appears to me a rational formula for the fluid extract or essence.

Although hydraulic pressure is undoubtedly the best for the purpose, a good screw-press answers fairly well, and the "Enterprise" press is still better. Operating then on 1 lb. of pods, the formula I would suggest is as follows:

Senna pods, slighly bruised	1 lb.
Rectified spirit	5 oz.
Distilled water	12 oz.

Press the pods well down in the containing vessel and pour on the mixed spirit and water; in twenty-four hours reverse the position of the pods and allow to stand a further period of four to five hours, subject to strong pressure; set aside the liquid in a bottle, break up the marc, and pour on this the following previously mixed:—

Glycerin	1 oz.
Liquid ammonia	20 minims.
Distilled water	19 oz.

Allow to stand four hours, press strongly, strain and evaporate the liquid so obtained, until when well mixed with the first liquor and filtered 16 fluidounces will be produced. The addition of one drop each of oil of caraway and essence oil of almonds, with two drops of essence of lemon, makes it really palatable. The medium adult dose is one fluidrachm.

PROTOPLASM AND ITS HISTORY.[1]

By Professor George L. Goodale.

You are invited to examine the more recent additions to our knowledge of protoplasm, restricting the examination to discoveries in the field of botany.

The word protoplasm was coined by Hugo von Mohl in order to designate certain active contents of the vegetable cell. We shall gain in clearness of vision by letting our glance rest first on the results of investigating vegetable cells and cell contents, anterior to von Mohl's time, in order that we may see some of the steps by which this term was reached by him. In 1667, Robert Hooke, of England, published an account of his investigations of minerals, plants and animals under the microscope. His first reference to the structure of plants is in his description of charcoal, and this is followed by a good account of common cork. In these brief and fairly accurate descriptions the author makes use of the word "cell," applying the term to the cavities in charcoal and in cork.

Hooke's interesting treatise was soon followed by two remarkable memoirs—one by an Italian, the other by an Englishman. Malpighi, of Bologna, sent to the Royal Society of London, in 1670, a work entitled Anatome Plantarum. At the period these volumes were in the hands of the Royal Society, Nehemiah Grew, Secretary of the Society, was engaged in work almost identical with that of Malpighi. By Grew the word "cell" appears to have been applied to the cavities in what we may call the softer tissues of the plant. It is certain that neither Malpighi nor Grew recognized, as we can now, the multifarious forms of vessels, fibres, long cells and the like as referable to a common source.

In 1804, the Royal Society of Sciences at Göttingen proposed for competition certain questions relative to the structure and the mode of growth of the tissues. The chief contestants for this prize were Link, Rudolphi and Treviranus. The memoirs of the first two received the prize, that of the latter honorable mention. The names of others should be referred to as having worked at or about this time in the same field, namely: Bernhardi, Mirbel and Moldenhauer, the latter making a great advance in certain directions. But to all of these whom I have mentioned, including the winners of the prize, the important question seems to be, how are the structural elements distributed, rather than how they are related to each other in manner of growth and as respects their origin. With the cell contents they had comparatively little to do. They were busy with the constituents of the frame-work.

Noting the more important discoveries of the next period in their order, we come first upon that of the nucleus of vegetable cells by Robert Brown in 1833 and one mode of cell division by Mohl in 1835. In 1838, the eccentric Schleiden published his Contributions to Phytogenesis, in which he states substantially that cells of plants can be formed only in a fluid containing, as chief ingredients, sugar and mucus (*Schleim*). By this latter term he designated the nitrogenous matters taken collectively and for the first time the vegetable cell was distinctly recognized as a unit of structure always serving as the common basis for the formation of the innumerable shapes of the structural elements.

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[1] From an address delivered by Prof. George L. Goodale, of Harvard University, as Vice-President of the Biological Section of the A. A. A. S., at Toronto, Aug. 28, 1889; abstracted and condensed from the "Botanical Gazette" by G. M. Beringer.

Next comes the master, Mohl. In 1844, in a paper on the circulation within vegetable cells, he speaks of the living mass in each active cell and distinctly recognizes it as that which is the treasury of stored energy and the vehicle of energy under release. He describes it as that which builds shapely forms out of unformed matter and at first hands. This substance he names *protoplasma*.

The term protoplasm was at once adopted by Schleiden, as a good substitute for the indefinite and misleading word *schleim*, which he had employed to designate, essentially the same substance, and it became thoroughly established in scientific terminology. In 1850, Prof. Cohn (and Unger in 1855), showed that the protoplasm of vegetable cells is identical with what had been described, in 1835, in animal structures as *sarcode* by Dujardin.

Mohl gives the following account of protoplasm. "If a tissue composed of young cells be left some time in alcohol, or treated with nitric or muriatic acid, a very thin, finely granular membrane becomes detached from the inside of the walls of the cells, in the form of a closed vesicle, which becomes more or less contracted, and consequently removes all the contents of the cell which are enclosed in this vesicle from the wall of the cell. This inner cell he calls the *primordial utricle*. In the center of the young cell, with rare exceptions, lies the so-called *nucleus cellulæ* of Robert Brown ('*Zellenkern*;' '*Cytoblast*' of Schleiden). The remainder of the cell is more or less densely filled with an opaque, viscid fluid of a white color, having granules intermingled in it, which fluid I call *protoplasm*."

Hofmeister's description of protoplasm, given in his Vegetable Cell (1867), is: "The substance protoplasm, whose peculiar behavior initiates all new development, is everywhere an essentially homogeneous body. It is a viscid fluid containing much water, having parts easily motile, capable of swelling and possessing in a remarkable degree the properties of a colloid. It is a mixture of different organic matters, among which albuminoids and members of the dextrin group are always present. It has the consistence of a more or less thick mucus and is not miscible with water to any great extent."

From these accounts we see that the following points were regarded as established: (1) All of the activities of the vegetable cell are manifested in its protoplasmic contents. (2) Protoplasm consists chemically of a nitrogenous basis. (3) Protoplasm has no demonstrable structure. (4) The protoplasmic contents in one cell are not connected with the protoplasmic contents in adjoining cells. (5) The nucleus and other vitalized granules in the vegetable cell are formed by differentiation from amorphous protoplasm. It is now our duty to see in what manner these views have been modified during the last twenty or rather ten years.

The first thesis, namely, that all of the activities of the vegetable cell are manifested in its protoplasmic contents, may be regarded as firmly established.

The second thesis, viz., protoplasm consists chemically of a nitrogenous basis, remains unchanged. But, instead of regarding the protoplasmic basis as comparatively simple, it is now known to be exceedingly complex and to contain numerous cognate proteids, some of which can be identified in the basic mass, others in the nucleus, and others still in the vitalized granules. As a result of recent studies, it becomes more and more clear that the chemical relations of the protoplasmic activities are still veiled in mystery. Botanists are now receding from the position that it is safe to use the words albuminoids and

protoplasm interchangeably, the latter term is generally restricted to morphological and physiological conceptions, the former keeps its wide chemical significance. The chemical studies of protoplasm by Rodewald, Reinke, Loew, Bokorny, and microscopically by Schwarz, compel us to recognize in protoplasm a substance of bewildering complexity of composition and constitution. Moreover, you all know how wide this field of research has suddenly become by the discovery that different microbes (which are, essentially, minutest masses of protoplasm) not only give rise to such diverse products, among others the ptomaines, but present such diverse chemical reactions. Protoplasm is no longer regarded by any one in any sense as a comparatively simple substance.

The third thesis, namely, protoplasm has no demonstrable structure, has been modified in a striking manner as a result of improved appliances for research. By better methods of staining, and by the use of homogeneous immersion objectives, the apparently structureless mass is seen to be made up of parts which are easily distinguishable. There has been, and in fact is now, a suspicion that some of these appearances, under the influence of staining agents are post-mortem changes and do not belong to protoplasm in a living state. But it seems to be beyond reasonable doubt that protoplasm is marvellously complex in its morphological and physical as well as its chemical constitution.

Fourth, we are to glance at the accepted statement that the protoplasmic body or protoplast of one cell is cut off by the cell wall from all connection with the contiguous cells. It has been shown by Gardiner and others that there are intercommunicating threads of protoplasm of extreme fineness between adjoining cells, and these living threads maintain connections, sometimes direct, sometimes indirect between one protoplasmic mass and another. This has been shown to be so widely true in the case of plants investigated that the generalization has been ventured on, that *all the protoplasm throughout the plant is continuous.*

The fifth thesis has been completely controverted. Instead of believing, as formerly, that all the granules within the cell arise *de novo* from the protoplasm in which they are imbedded, we are now forced to regard all of them as springing from pre-existent bodies of the same character. Hofmeister, in 1867, stated distinctly that the nucleus arises from homogeneous protoplasm, and that in all cell-division the nucleus must first disappear, two new ones arising in its place. The nucleus occupied a secondary place as a derivative organ, and the chlorophyll granules were believed by him and his contemporaries to be new formations from homogeneous protoplasm under certain conditions of light, temperature and food. Researches show that the nucleus in all cases hitherto examined springs from a pre-existent nucleus by a process of division.

The extraordinary manner in which the nucleus, both in common cell-division and in reproductive blending, carries ancestral characters and controls the distribution of nutritive materials is as yet the greatest mystery in vegetable life.

Formerly it was held that the other granules imbedded in the protoplasmic body known as chlorophyll granules, sprang by a process of differentiation from the shapeless mass in each exposed cell. Researches have shown beyond any reasonable doubt that these chlorophyl granules always arise by a process of division from pre-existent granules. It is known that at the growing points, where leaves are developed, the cells contain granules of about the consistence

and color of protoplasm itself (chromatophores), the products of whose division are three-fold, some of the resulting granules being colorless, others become true chlorophyll granules, while others still, in those leaves which become the leaves of the flower and the fruit, assume colors other than green.

Such, then, are some of the more important changes which have taken place with regard to our knowledge of the living contents of vegetable cells.

VARIETIES.

Syzygium Jambolanum, De Candolle.—Dr. C. Græser has experimented upon dogs rendered diabetic by the administration of phloridzin, and ascertained that the excretion of sugar was promptly reduced from 80 to 86 per cent. by the administration of extract of jambul, concentrated so that 100 gm. of fruit were represented by 16⅔ gm. of the kernel and 11⅔ gm. of the rind extract. The dose was 6 to 18 gm. daily.—*The Lancet*, Nov. 2, 1889.

Antidote for Morphine.—Professor Arpad Bokai (*Inter. Klin. Rundschau*) recommends picrotoxin as an antidote for morphine, on the ground that it exerts an antagonistic action to morphine on the respiratory centres; also that it is a powerful stimulant to the vaso-motor centre, and in this respect likewise an antagonistic to morphine; further, that the action of morphine on the cerebrum is directly opposed to that exerted by picrotoxin, and, finally, Professor Bokai suggests that the previous administration of a small dose of picrotoxin might reduce the danger of asphyxia in chloroform and narcossis.

Action of Hydrastis canadensis.—From his physiological experiments upon rabbits, Heinricus (*Fortschr. d. Med.*, June 15, 1889) concludes that small doses strengthen the respiration for a short time; large doses stop it for a time, and then render the movement superficial. He could not find it exercise any influence on the contractile power of the uterus or vagina.

The astringent and at the same time weak local anæsthetic action of hydrastine has led Felsenberg (*Wiener med. Blätter*) to employ the fluid extract of hydrastis in cases of chronic pharyngitis accompanied with tonsillar hypertrophy. On painting the affected mucous membrane several times daily, a distinct decrease of the redness and swelling became evident. The subjective symptoms quickly abated; the patient became readily habituated to the bitter taste.

Poisoning by Salt of Sorrel.—A man accidently swallowed about half an ounce of salt of sorrel dissolved in water. Within three minutes he experienced a severe burning pain in the gullet and stomach. Shortly after a brownish foam flowed from his mouth and he became partially unconscious. An emetic was administered, after which he vomited and was purged. He slept for two hours and on awaking had severe pain in the back. Three days after he was pale and haggard, tongue coated, intense thirst, temperature 102° F., perspired freely, great pain in lumbar region, tenesmns with blood-stained stools, urine high-colored. The patient recovered, but suffered from pain after taking food, constipation, and great debility for some time.—*R. Park in Glasgow Medical Journal*, September, 1889.

Pereirine and Quinine in Malarial Fever.—Dr. Tibiricá, physician to the Hospital Santa Veridiana in S. Paulo, Brazil, publishes in the *Revista Medica de S. Paulo* a paper on the "Advantages of employing Pereirine as an Adjuvant and

as a partial Substitute for Quinine in Malarial Fevers." Pereirine appears to augment the proper action of quinine without exerting any serious depressing effect on the heart. Instead, therefore, of prescribing quinine alone in 15 gr. doses, he orders 7½ gr. of quinine combined with an equal quantity of pereirine, a combination which appears to exert the same effect over the malarial fever as 15 gr. of quinine, but to be much less depressing to the heart.—*The Lancet*, November 2.

Antiseptic Solution for Sponges is recommended by Prof. Berrens to be made hy dissolving thymol 1, in alcohol 4, and adding distilled water 1,000 parts.—*Gaz. Gynoc.*

Oil of Turpentine in Whooping-cough.—Dr. Vascencellos des Post employs turpentine in whooping-cough by dropping it upon the child's pillow, thus causing constant inhalation of the vapor; or it is given in capsules, or in the form of a mixture combined with belladonna, or as an enema.—*L'Union Méd.*, October 12, 1889.

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, December 17, 1889.

The meeting was organized by calling Mr. Wm. B. Webb to the chair.

The minutes of the last meeting were read and no corrections being called for they were approved.

A paper upon the *purification of benzin* for pharmaceutical and chemical purposes was read by Mr. Geo. M. Beringer, Ph. G.; it was accompanied by specimens of the crude and purified articles; the freedom from all unpleasant odor when permitted to evaporate was noticed by those who examined the samples. Professor Trimble inquired what proportion of benzin was recovered in the distillation. Mr. Beringer said he could not state the percentage recovered, but that the process could be economically done even at a large loss of benzin when compared with the cost of the article sold as petroleum ether.

Mr. Joseph W. England called attention to the article known commercially as *synthetic carbolic acid*, the melting point of which is given at 41° C. or several degrees higher than that of the crystallized carbolic acid of the market. Its odor is also different, being less penetrating and more pleasant.

Mr. England read a paper upon *pharmaceutical incompatibility*, discussing practical questions which are of frequent occurrence.

A sample of *saffron* was exhibited by Professor Trimble which had been presented to him by Mr. J. L. Lemberger, of Lebanon, Pa. It was similar to that described by Mr. Beringer last month. A sample of it was examined microscopically by Mr. Bullock who reports on it as follows:

"Water dissolves the coloring matter and a heavy white powder is deposited; the color given to the water is not that of saffron, but resembles the aniline color saffranine. After removal of most of the color by water the addition of a dilute solution of chlorinated soda bleached the fibres entirely. When dissected by needle points it was resolved into filaments the entire length of the pieces; these when placed upon a microscope slip and moistened with a

solution of chloride of zinc containing iodine gave to the interior structure the blue color of cellulose, the outside sheath staining yellow. After bleaching, nodes with buds are distinctly visible on many of the pieces. The material appears to be a species of grass stained with saffranine, and is doubtless the same adulterant referred to by Geo. M. Beringer in his paper published in the December number of the AMERICAN JOURNAL OF PHARMACY. A lot of this saffron has been distributed among the wholesale trade in Philadelphia at a price nearly approaching that of pure saffron. A sample can submitted to us had pure saffron on top, and beneath the mixture containing about 80 per cent. of impurity."

Professor Trimble read a paper in reply to some criticisms on a paper published in the AMERICAN JOURNAL OF PHARMACY, page 398, for 1889, upon *oils of wintergreen and birch.* The paper was illustrated with a few experiments showing the accuracy of his statements. All the above papers were referred to the Publication Committee.

A letter from Mr. W. H. Shively, Ph. G., of the class of 1842, was read, congratulating the college upon the great advances made in the educational department of the college, and expressing his best wishes for its continued prosperity.

There being no further business, on motion adjourned.

T. S. WIEGAND,
Registrar.

OBITUARY.

Edward B. Garrigues deceased at his residence in this city on the 3d day of November, 1889, in the 95th year of his age.

He was the last of the sixty-eight original members who founded the Philadelphia College of Apothecaries in 1821. The minutes of the College inform that the above number of members comprised about one-half of the druggists and apothecaries at that time engaged in business in Philadelphia.

In 1822 the College was incorporated by the Legislature of Pennsylvania as the Philadelphia College of Pharmacy. In 1826 Mr. Garrigues was elected Treasurer of the College and served as such until September, 1838, when he resigned his membership in the College on account of having retired from the drug business. In accepting his resignation the thanks of the College were presented to him "for his long-continued and faithful discharge of the duties of that office," and he was requested to retain his certificate of membership as an evidence of the appreciation of the College for his services.

In 1879, by direction of the College, his name was again placed on the roll of active members with remission of all annual dues.

Mr. Garrigues was born in Philadelphia on the 8th of October, 1795—his great-grand father was among the Huguenots who left France after the revocation of the edict of Nantes in 1685. The family name was De la Garrigue.

His early education was at "West-town," a school conducted by the Society of Friends. At a suitable age he was apprenticed to John Hart, whose store was on Second street below Market street, to learn the drug business; after serving his time, he opened a store on Sixth street above Market street, subsequently removing to the N. W. corner of Market and Sixth streets, where he conducted a successful business for nearly twenty years. He then built a store and dwelling at the N. W. corner of Sixth and Spring Garden streets, to which place he removed his business; after remaining here a few years he disposed of his business and retired.

Meeting with losses in other mercantile ventures he returned to the drug business in 1843, locating at the N. E. corner of Tenth and Fairmount avenue, and continued in business until January, 1887, when advancing age counselled his retirement—leaving the conduct of the business in the hands of his partner, E. M. Boring.

Educated in the Society of Friends and conforming through a long life to the customs of that Society in language and apparel, he was in this respect the last of its numerous members who have done honor to the business of Druggist and Apothecary in Philadelphia. He was for a time a manager of Friends' Asylum for the Insane at Frankford, a trustee of Haverford College, and a school director in the district of Spring Garden.

A man of even and genial temperament, courteous in address and pleasant in his intercourse, he was esteemed by those who knew him. He leaves two daughters—his son Samuel S. Garrigues, a graduate of this College, deceased in May, 1889. C. B.

CLASSES

—OF THE—

PHILADELPHIA COLLEGE OF PHARMACY,

SIXTY-NITNH ANNUAL SESSION, 1889-1890.

JUNIOR CLASS.

Name.	*Place.*	*State.*	*Preceptor.*
Akers, Frank Leamer,	Hollidaysburg,	Pa.	T. W. Snyder.
Arnold, Henry Peter,	Philadelphia,	Pa.	Lantz Bros.
Baer, Elizabeth Houton,	Philadelphia,	Pa.	
Baker, Thomas Jennings,	Easton,	Pa.	R. W. Cuthbert, Ph.G.
Bast, Charles Lewis,	Baden,	Germ'y	N. A. Cozens, Ph.G.
Baumgartner, Wm. Jacob,	Philadelphia,	Pa.	L.W. Hildenbrand, M.D.
Beavers, Frank Washington,	Scranton,	Pa.	G. W. Jenkins.
Beck, Robert Wilbert,	Sharon,	Pa.	A. L. Beck, Ph.G.
Bender, Edward Augustus,	Elm,	Pa.	L. C. Funk, Ph.G.
Besore, Alexander Stewart,	Shippensburg,	Pa.	J. L. Supplee, Ph.G.
Bietsch, George Edward,	Chambersburg,	Pa.	W. E. Lee, Ph.G.
Binkley, Harry Jonathan,	Wernersville,	Pa.	W. F. Potteiger, Ph.G.
Bitler, Harry,	Reading,	Pa.	Wm. M. Koenig.
Blair, Henry Cowan, 3d,	Philadelphia,	Pa.	H. C. Blair's Sons.
Blow, Robert Gillingham,	Beverly,	N. J.	Dr. A. W. Taylor.
Boggs, Harry Leslie,	Charleston,	W. Va.	E. L. Boggs.
Bonfoey, Hubert Raymond,	Waverly,	N. Y.	C. F. Chaffe
Boyer, Franklin Nagle,	Reading,	Pa.	J. A. Gingrich, Ph.G.
Boyles, Col. James Clarkson,	DuBois,	Pa.	Dr. R. M. Boyles.
Breidinger, Lewis Abraham,	Philadelphia,	Pa.	J. H. Munson, Ph.G.
Bresser, Otto Charles,	Scranton,	Pa.	Carl Lorenz.
Brice, Wm. Otto,	Winnsboro,	S. C.	C. Shivers.
Bridgman, Wm. George,	Liverpool,	Eng.	H. Lee Barber.
Bright, Harry H.,	Bernville,	Pa.	Dr. W. E. Donough.
Brown, Albert Ludwig,	Reading,	Pa.	McCurdy & Durham.
Brown, Charles,	Philadelphia,	Pa.	W. J. Pechin.
Brown, Frank Luther,	Lebanon,	Pa.	R. P. Marshall, Ph.G.
Bunker, Wm. Beatty,	Bellefontaine,	Ohio	E V. Pechin.
Burdick, Arch. Webster,	Carbondale,	Pa.	A. W. Reynolds.
Butz, Alfred Sylvester,	Kutztown,	Pa.	E. J. Sellers.
Campbell, Theodore,	Daretown,	N. J.	Geo. H. Whipple.
Carmany, Henry Batdorff,	Myerstown,	Pa.	Dr. W. C. Kline.
Carpenter, Wm. Asbury,	Georgetown,	Del.	D. G. E. Musselman.
Carrow, Richard Norris,	Camden,	Del.	Jas. L. Graham, Ph.G.
Carson, Henry Martin,	Hastings,	Neb.	Dr. C. D. S. Fruh, Ph.G.
Clayton, McClellan,	Mannington,	W. Va.	J. C. Dent.
Clingan, Wm. Arthur,	Sioux City,	Iowa	
Cochran, Ardesco Bright,	Apollo,	Pa.	T. A. Cochran.
Collins, Willard Love,	Montoursville,	Pa.	J. R. Smyser, Ph.G.

Name.	*Place.*	*State.*	*Preceptor.*
Colquhoun, John H.,	Upland,	Pa.	O. P. Hooper, Ph.G.
Comfort, Newton C.,	Mechanicsburg,	Pa.	Henry Mueller, M.D.
Cooper, Herbert,	Dover,	Del.	H. S. Eckels.
Coulomb, C. A.	Philadelphia,	Pa.	
Coxe, Russel LeVan,	Schuylk'l Haven	Pa.	H. N. Coxe.
Crouse, James Norton,	Logania,	Pa.	T. Hetherington, Ph.G.
Cunningham, T. S. McNeilly,	Clarksville,	Tenn.	Askew & Edwards.
Daley, Miles Ferris,	Waterbury,	Conn.	Dr. Geo. O. Robbins.
Danner, John,	Bethlehem,	Pa.	H. K. Mulford, Ph.G.
Davis, Harry Morgan,	Haverford,	Pa.	Harry Cox, Ph.G.
Deen, William Lewis,	Lancaster,	Pa.	John F. Long's Sons.
Devine, Oliver Crawford,	Philadelphia,	Pa.	Dr. Devine.
De Vries, Robert Tivis,	Wheeling,	W. Va.	Chas. Menkemeller.
Dickel, William John,	Philadelphia,	Pa.	F. F. Drueding, Ph.G.
Donoghue, Robert Ligonius,	Philadelphia,	Pa.	W. A. Musson.
Douty, John Blundon,	Shamokin,	Pa.	H. Moll & Co.
Dreisbach, Luther Albert,	Easton,	Pa.	Wm. H. Hamman.
Elliott, Walter Roland,	Renovo,	Pa.	W. E. Hall.
Elston, Clarence William,	Downingtown,	Pa.	J. H. Stermer, Ph.G.
Eppstein, Jacob,	Hoppstardten,	Germ'y	C. E. Spenceley, Ph.G.
Eshbach, Wiliam Wallace,	Bethlehem,	Pa.	Dr. Geo. P. Kern.
Fadeley, Robert Wesley,	Philadelphia,	Pa.	Jas. Huston.
Ferguson, Enoch Pennock,	Coatesville,	Pa.	A. G. Miller.
Fernsler, Edward Shoener,	Pottsville,	Pa.	James N. Hodgson.
Fessler, Thomas Addison,	Muncy,	Pa.	W. P. I. Painter & Son.
Fies, John Henry,	Lancaster,	Pa.	A. A. Hubley.
Finney, John Joseph,	Conshohocken,	Pa.	H. J. G. Hallowell.
Fisher, Joshua Fetterman,	Catawissa,	Pa.	Norman G. Ritter, Ph.G.
Fox, Charles,	Philadelphia,	Pa.	
Freeman, George Washington,	Philadelphia,	Pa.	F. C. Davis.
Fredericks, Harry,	Philadelphia,	Pa.	L. C. Funk, Ph.G.
Frey, Frank Joseph,	Union Oity,	Ind.	John P. Frey, Ph.G.
Fry, Harry Edmund,	Forksville,	Pa.	W. T. Randall.
Fry, Nelson Becker,	Harrisburg,	Pa.	Jas T. Shinn, Ph.G.
Furl, Irwin William,	Lock Haven,	Pa.	Franciscus & Co.
Gamp, Joseph,	Philadelphia,	Pa.	French, Richards & Co.
Garcia, Juan Reyes,	Porto Rico,	W. I.	R. C. Martin.
Garges, Alfred Ball,	Zanesville,	Ohio	Graham & Co.
Gerlach, Frank Christian,	Wooster,	Ohio	J. Zimmerman & Co.
Good, Benjamin Mylin,	Lancaster,	Pa.	C. A Heinitsh, Ph.M.
Goos, Charles	Philadelphia,	Pa.	Wm. A. Fetters, Ph.G.
Gorrell, Jr., Benjamin Harvey,	Lexington,	Va.	B. H. Gorrell.
Graham, Fred. William W.,	Philadelphia,	Pa.	
Gressley, William Robert,	York,	Pa.	B. S. Gilbert & Co.
Grotevent, John Frederick,	Harrisburg,	Pa.	Dr. T. E. Conard, Ph.G.
Gruhler, Christian,	Shenandoah,	Pa.	A. Wasley.
Guest, Owen Lovejoy,	Swedesboro,	N. J.	S. S. Guest, Ph.G.
Haake, Wm. Henry,	Cleveland,	Ohio	A. Mayell & Co.
Hadley, Harry Cornish,	Kennett Square,	Pa.	D. W. Hutchison.
Hague, Wm. Henry,	Barnesville,	Ohio	T. H. Potts, Ph.G.
Haines, Joseph Ridgway,	Mount Holly,	N. J.	Prickitt & Barrington.
Hall, Thomas Murphy,	Middletown,	Del.	Howard Knight, Ph.G.
Hamilton, James Harry,	Mount Holly,	N. J.	E. B. Jones.
Hammerquist, Charles,	Jamestown,	N. Y.	H. C. Lawall, Ph.G.
Hankey, William Tabor,	Trempealeau,	Wis.	T. H. Spence.
Harbach, Charles Cathrall,	Falls Schuylkill,	Pa.	Dr. Eli S. Beary.
Harders, Mae Thompson,	Philadelphia,	Pa.	Dr. S. Hayhurst, Ph.G.
Harrington, Geo. Washington,	Hazleton,	Pa.	Dr. L. H. Smith.
Hartman, Frank Gast,	Lancaster,	Pa.	Sam'l B. McCleery, M.D.

Name.	*Place.*	*State.*	*Preceptor.*
Haydock, Susannah Garrigues,	Philadelphia,	Pa.	Dr. S. Hayhurst, Ph.G.
Hayes, John Carroll,	Mifflinburg,	Pa.	D. H. Ross, Ph.G.
Head, Raymond Cyril,	Latrobe,	Pa.	Jos. Fleming & Son.
Heckler, Franklin Jacob,	Columbia,	Pa.	P. S. Brugh.
Heichhold, Henry Philip,	Philadelphia,	Pa.	C. H. Bohn.
Henry, Wm. Frederick,	Bellaire,	Ohio	M. N. Mercer.
Herber, Conrad J. Aug. Steph'n,	Terre Haute,	Ind.	John T. Gulick.
Herr, Harry Eastburn,	Masonville,	N. J.	D. W. L. Matthews.
Hicks, Henry Thomas,	Raleigh,	N. C.	J. S. Pescud.
Hill, William Maurice,	Lansford,	Pa.	J. H. Kerr, Ph.G.
Hoch, Jacob,	Easton,	Pa.	Milton M. Buss.
Hohman, Theodore Albert,	Wheeling,	W. Va.	Chas. R. Goetze, Ph.G.
Horn, Edgar Austin,	Lehighton,	Pa.	Dr. C. T. Horn.
Hough, John Wallace,	Shippensburg,	Pa.	J. C. Attick & Co.
Hudson, Charles Marcus,	Stockton,	Md.	E. Fountain.
Hutchison, Burtt Taylor,	Bangor,	Pa.	S. E. R. Hassinger, Ph.G.
Hutchinson, William,	Delaware City,	Del.	W. A. Jester.
Ingram, Edgar Wilson,	Lewes,	Del.	A. T. Pollard & Co.
Ingram, John S.	Atlantic City,	N. J.	Dr. U. Ingram.
Irvine, John,	Carlisle,	Pa.	A. Tatem, Ph.G.
Irwin, Robert Sloan,	Newtown,	Pa.	C. G. A. Loder, Ph.G.
Janney, Edward Walker,	Philadelphia,	Pa.	R. Shoemaker & Co.
Jones, William,	Waterville,	N. Y.	E. G. Bissell, Ph.G.
Jones, William Hewitt,	Lansford,	Pa.	Dr. J. Benj. Jones.
Kasten, William Henry.	E. Mauch Chunk	Pa.	Jas. M. Hess.
Kessler, Francis Edward,	Logan,	Ohio	F. W. E. Stedem, Ph.G.
Ketterer, Martin,	Philadelphia,	Pa.	J. C. Phillips.
Keyes, James Elihu,	Oneonta,	N. Y.	E. E. Ford.
Kinsel, Grant Arthur,	Lewistown,	Pa.	A. P. Martin.
Kirk, Samuel Bird,	Curwensville,	Pa.	
Kitchen, Charlie E.	Piqua,	Ohio	Pearl I. Hedges.
Kittson, Edwin Forrest,	Media,	Pa.	W. E. Dickeson.
Koch, Louis Homer,	Leetonia,	Ohio	Harper & Witzeman.
Koenig. Albert,	Philadelphia,	Pa.	D. Milligan.
Krall, George Heyde,	Mechanicsburg,	Pa.	Eberly Bros.
Krapf, Daniel,	Eckhart Mines,	Md.	
Krebs, Harry Jacob,	Mahanoy City,	Pa.	A. C. Weber, Ph.G.
Krebs, Paul,	Cleveland,	Ohio	Herman Krebs.
Kulp, Austin William,	Lock Haven,	Pa.	T. C. Hilton & Co.
Kunkel, Daniel,	New Ringgold,	Pa.	Dr. A. S. Erney.
Lack, Charles Eugene,	Bethlehem,	Pa.	H. F. Backenstoe, Ph.G.
La Dow, Addington,	Newport,	N. Y.	E M. Smyser, M.D.
Landon, Francis Patterson,	Salem,	N. J.	F. W. Fenn.
Lane, Samuel Hetich,	Mecersburg,	Pa.	Chas. M Edwards.
Lefferts, Henry Tomlinson,	Southampton,	Pa.	J. N. Antill, Ph.G.
Lehman, Edward,	Memphis,	Tenn.	Dowdy & Co.
Leinbach, Frank Irwin,	Antes Fort,	Pa.	Thos. D. Baker, Ph.G.
Levergood, John Lane,	Wrightsville,	Pa.	Dr. W. L. Mathews.
Lewis, John Frederick, Jr.,	Gordon,	Pa.	J. E. Gregory, Ph.G.
Long, Harvey,	Middletown,	Pa.	John W. Renalt.
Lumb, Charles Thomas,	Frankford,	Pa.	Abram L. Lumb.
Lupin, Emanuel,	Russia,	Europe	H. K. Mulford, Ph.G.
Lupus, Herman Earnest,	Camden,	N. J.	Alexander A. Weber.
Lynch, Edmund Thomas,	Wilmington,	Del.	H. R. Bringhurst.
Lyons, Frank Floyd,	Youngstown,	Pa.	McEwen & Breaden.
MacFaden, Douglas Henry,	Philadelphia,	Pa.	Valentine H. Smith.
McBride, James Edward,	S. Bethlehem,	Pa.	Sheets & Addis.
McClellan, Samuel Lee,	Cochransville,	Pa.	S. K. Hammond.
McClintock, James,	Germantown,	Pa.	Warren A. Poley.

Name.	*Place.*	*State.*	*Preceptor.*
McDonnell, Chas. Pancratius,	Philadelphia,	Pa.	Dr. J. M. Wallis.
McFarland, Robert,	Philadelphia,	Pa.	W. N. Stansbury, Ph.G.
McGregor, Eugene Charles,	Columbia,	S. C.	W. C. McGregor.
McLaughlin, Philip Celestine,	York,	Pa.	Dale, Hart & Co.
MacLennan, Wm. Feinour,	Philadelphia,	Pa.	W. F. Steinmetz.
McMeekan, Chas. Jas. Harvey,	Germantown,	Pa.	C. E. Davis.
McMillan, W. C.,	Marion,	S. C.	W. C. McMillan (Dec'd)
Main, Clinton Eugene,	Frederick,	Md.	S. Schley & Co.
Manning, Charles La Forge,	Trenton,	N J.	Wm. H. Laubach, Ph.G.
Markley, William Arnold,	Reading,	Pa.	John B. Raser.
Martin, Warren Dickerson,	Ambler,	Pa.	Charles Rutherford.
Matthews, Edgar Morton,	Jefferson,	Ga.	H. H. Bell.
Mauter, Fred. Augustus,	Farmington,	Me.	W. H. Braddock.
Mayer, Max B.,	Ashland,	Pa.	S. C. Voshage.
Mayes, Thomas Enoch,	Lewistown,	Pa.	J. A. Matthews' Sons, Ph.G.
Mendenhall, Harry Carleton,	Bloomsburg,	Pa.	J. B. Moore.
Mengel, Levi Walter,	Reading,	Pa.	Chas. M. Steinmetz.
Meroney, John Patrick,	Camden,	S. C.	Geo. B. Evans.
Miller, Franklin James,	S. Bethlehem,	Pa.	Dr. F. S. Buchman.
Milliken, William Houston,	Philadelphia,	Pa.	Edward C. Jones.
Mitchell, Henry,	Philadelphia,	Pa.	C. W. Hallowell.
Moon, Joaquin Richard,	Morrisville,	Pa.	S. C. Pryor.
Moore, Frank Reynolds,	Clarksburgh,	W. Va.	H. L. Wells.
Moore, James Johnson,	Dillsburg,	Pa.	Dr. H. W. Fisher.
Morales, Guadalupe,	Nicaragua,	C. Am.	Dr. Morales.
Morgan, Julius Everard,	Smithfield,	N. C.	H. C. Blair's Sons.
Muhn, Harry Jacob,	Wheeling,	W. Va.	Ch. Menkemeller, Ph.G.
Mullen, J. A.,			
Murrell, Alexander Harrison,	Allen,	Md.	Dr. H. B. Taylor.
Myers, Arnold Armstrong,	York,	Pa.	J. H. Buckingham, Ph.G.
Myers, Henry Joseph,	Philadelphia,	Pa.	J. B. Cook.
Meyers, Louis Joseph,	Conshohocken,	Pa.	Eberly Bros.
Noon, Edward John,	Philadelphia,	Pa.	L. Genois, Ph.G.
Nusbaum, Benjamin,	Philadelphia,	Pa.	C E. Spenceley, Ph.G.
Otis, Amos Ray,	Hicksville,	Ohio	S. S. Loughridge, Ph.G.
Osborne, Albert Edgar,	Wallingford,	Pa.	Wardle Ellis, Ph.G.
Outen, Albert Petit,	Philadelphia,	Pa.	Daniel Follmer.
Parmer, Edward Elmer,	Camden,	N. J.	R. S. Justice.
Parvin, Harry Rocap,	Bridgeton,	N. J.	H. F. Seeley.
Paxson, Elmer May,	Philadelphia,	Pa.	H. James Batdorff, Ph.G.
Pazmiño, Francisco,	Machela,	S. A.	H. C. Manlove.
Pfeuffer, Willie, Otto, Robert,	New Braunfels,	Texas	Jno. N. Bodenman.
Phillips, Lehman Blew,	Bridgeton,	N. J.	Harrison Duffield, M.D.
Phipps, Amos Joseph,	Chestnut Hill,	Pa.	F. H. Poley.
Phipps, Claud,	Yuba City,	Cal.	
Portser, Charles Henry,	Saltsburg,	Pa.	Harry C. Watt.
Post, Francis Elmer,	Towanda,	Pa.	H. C. Lutz.
Prickitt, Charles Abram,	Mt. Vernon,	N. J.	B. T. Davis.
Prior, James Conrad,	Philadelphia,	Pa.	
Randal, Harry Lee,	Shepherdstown,	W. Va.	Charles C. Sanderson.
Randolph, B. Alfred,	Houston, Texas,	E. L.	E. Castleton, Ph.G., M.D.
Randolph, Thomas Owen,	Versailles,	Ohio	T. M. Newbold, Ph.G.
Raudenbush, Chas. Hunter,	Reading,	Pa.	Jacob H. Stein, Ph.G.
Reap, Edward Augustine,	Pottstown,	Pa.	Joseph Feldman.
Reif, Ernest,	Philadelphia,	Pa.	John A. Martin, Ph.G.
Remsen, John Edward,	Honesdale,	Pa.	J. F. Brody.
Reuss, William Henry,	Philadelphia,	Pa.	W. H. Morrett.
Riegel, Samuel Jacob,	Lebanon,	Pa.	Jos. L. Lemberger, Ph.G.
Rinedollar, Robert Grant,	Philadelphia,	Pa.	Wiley & Wallace.

Name.	*Place.*	*State.*	*Preceptor.*
Rinker, Francis,	Mt. Airy, Phil'a.	Pa.	J. A. Jeffries, Ph.G.
Robertson, John,	Mt. Carmel,	Pa.	Alva F. Tod, Ph.G.
Ruhl, Harry Fry,	Manheim,	Pa.	
Ruth, Solomon H.,	Sinking Springs,	Pa.	McCurdy & Durham.
Scarborough, George Walter,	Calvert,	Md.	Frank More, Ph.G.
Schaak, Milton Franklin,	Lebanon,	Pa.	G. W. Schools, Ph.G.
Scheirer, Franklin Benjamin,	Hokendauqua,	Pa.	W. O. Higgate, Ph.G., M.D.
Scheirer, Victor Daniel,	Allentown,	Pa.	Weber & Good.
Scherer, Bernhard Frederick,	Philadelphia,	Pa.	C. E. Haenchen.
Schmidt, Justus,	Dayton,	Ohio	N. T. James.
Schroeder, Martin Bernard,	Philadelphia,	Pa.	John A. Murtagh.
Scott, Robert Burns,	Philadelphia,	Pa.	Dr. J. W. Ranck.
Seltzer, Charles Jacob,	Coatesville,	Pa.	W. S. Young, Ph.G.
Shafer, Erwin Clement,	Montoursville,	Pa.	Dr. Geo. C. Saeger.
Sharp, John M.,	Philadelphia,	Pa.	E. W. Sharp.
Sharp, Warren Read,	West Chester,	Pa.	Wm. H. Lacey.
Sheehan, Edward Joseph,	Utica,	N. Y.	Stryker & Ogden.
Shore, Thomas Walter,	Philadelphia,	Pa.	J. O. Kooker, Ph.G.
Shull, Carl Whittaker,	Bridgeton,	N. J.	J. V. Slaughter, Ph.G.
Shuman, Calvin Bruce,	Bloomsburg,	Pa.	H K. Mulford, Ph.G.
Sickel, William Allen,	Bristol,	Pa.	Emlin Martin.
Siegfried, Howard Joseph,	Nazareth,	Pa.	E. B. Garrigues & Co.
Simmons, George Arthur,	Moores,	Pa.	F. E Harrison.
Simmons, Frank Waters,	Pottsville,	Pa.	W. A. Smith.
Singer, Robert Lamberton,	Harrisburg,	Pa.	Dr. E. A. Eyster.
Smith, Benjamin Franklin,	Harrisburg,	Pa.	Dr. J. H B. Amick.
Smith, Charles Adam,	Obold's P. O.,	Pa.	J. C. Griesemer.
Smith, Gilbert Slack,	Goshen,	N. J.	Dr. A. N. Tomlin.
Smith, Harry Allen,	Philadelphia,	Pa.	Van Buskirk & Apple.
Smith, Harry Clay,	Millville,	Pa.	Dr. H. C. Smith.
Smith, Herbert Johnson,	Elkton,	Md.	T. C. Tomlinson, M.D.
Solliday, William W.,	South Easton,	Pa.	Allen Spengler.
Speer, Edgar Lacey,	Chambersburg,	Pa.	J. S. Nixson & Son.
Spencer, Edward Thomas,	Newville,	Pa.	H. K. Mulford & Co.
Springer, Edward Franklin,	Wilmington,	Del.	J. M. Harvey, Ph.G.
Stein, Edward Theo. North,	Millersville,	Pa.	Wm. McIntyre, Ph.G.
Stem, Harvey Nevin,	Allentown,	Pa.	Heiberger & Stein.
Stiles, William Herbert,	Camden,	N. J.	Edward C. Jones & Co.
Stirling, David Clayton,	Philadelphia,	Pa.	S. C. Blair.
Stoffregan, Louis Franklin,	Pottsville,	Pa.	C. S. Commings, Ph.G.
Strode, William Alvah,	Elmira,	N. Y.	H. C. Blair's Sons.
Strouse, Theodore Herman,	Pottsville,	Pa.	H. F. Voshage.
Sultzbach, Harry Miller,	Marietta,	Pa.	A. D. Wike.
Swartly, Harry C.,	Norristown,	Pa.	Henry C. Blair's Sons.
Sweeney, Joseph Henry,	Mahanoy City,	Pa.	T. B. Bechtold.
Sweeney, Charles Washington,	Philadelphia,	Pa.	Wm. G. Toplis, Ph.G.
Taggart, George Corson,	Norristown,	Pa.	J. A. Ogden, M.D.
Tagzart, Howard M ,	Philadelphia,	Pa.	C. H. Wagner.
Taylor Merle Hampton,	Butler,	Pa.	J. H. Parks.
Taylor, William Francis,	Cleveland,	Ohio	W. J. Huck.
Teeple, Harry Sutherland,	Campbell,	N. Y.	H. B. Willard.
Thompson, Oan Joshua,	Reading,	Pa.	J. M. Malatesta, Ph.G., M.D.
Thompson, Warren Ethelbert,	Wilmington,	Del.	
Tielke, Maxwell Gustav,	Cleveland,	Ohio	G. Tielke.
Truman, Elliot Davis,	Wells Bridge,	N. Y.	
Turner, Philip Percy,	Millington,	Md.	H. D. Diefenbeck.
Van Buskirk, Thos Franklin,	Bethlehem,	Pa.	S. L. Van Buskirk, M.D.
Voss, Frederick John,	Hanover,	Germ'y	Dr. Drueding,
Walls, John Henry,	Media,	Pa.	L. F. Tovar, M. D.

Name.	*Place.*	*State.*	*Preceptor.*
Walter, Andrew,	Philadelphia,	Pa.	W. F. Dugan.
Walmsley, James Winter,	Gloucester,	N. J.	Dr. Walmsley.
Waterall, Charles Albert,	Philadelphia,	Pa.	Wm. Waterall & Co.
Weber, Frank Charles,	Meadville,	Pa.	C. M. Zinck.
Weber, Frank Nicholas,	Millville,	N. J.	Geo. W. Weber, Ph.G.
Weisner, Nicholas Frederick,	Leesport,	Pa.	L. A. Podolski.
Westcott, Frank,	Media,	Pa.	W. E. Dickeson.
Weston, Geary Augustus,	Millersville,	Pa.	Dr. T. N. Reeder.
Whipple, Oscar Kellog,	Bridgeton,	N. J.	Geo. H. Whipple.
Whitaker, George Nixon,	Cedarville,	N. J.	C. H. Bateman.
White, Frank Willett,	Atchison,	Kan.	John W. Allen.
Williams, Clarence Edward,	Philadelphia,	Pa.	Bullock & Crenshaw.
Wissler, Arthur John,	Edinburg,	Va.	
Wolff, Oliver Brown,	Dry Run,	Pa.	Robt. McNeil, Jr.
Wollmuth, Richard Julius,	Bethlehem,	Pa.	J. J. Parker.
Wright, Thomas Edward,	Germantown,	Pa.	Bullock & Crenshaw.
Yarnall, John Winters,	Mt. Carmel,	Pa.	Geo. E. Dahis, Ph. G.
Zeamer, Harry Wissler,	Columbia,	Pa.	J. T. Shinn, Ph.G.
Zeller, John Paul,	Mifflinburg,	Pa.	T. J. Lightcapp, Ph.G.
Zerr, Samuel N. Z.,	Reading,	Pa.	P. M. Ziegler.
Ziegler, Albert Lewis,	York,	Pa.	S. M. Gable.

SENIOR CLASS.

Name.	*Place.*	*State.*	*Preceptor.*
Adams, Franklin Irving,	Amsterdam,	N. Y.	Jas. A. Barkhuff, Ph.G.
Allen, John Maskell	Salem,	N. J.	Jas. T. Shinn. Ph.G.
Alsentzer, Charles Frederick,	Wilmington,	Del.	F. Roop Smith, Ph.G.
Angeny, Ferdinand Gisler,	Doylestown,	Pa.	Harlan Cloud, Ph.G.
Apple, Franklin Muhlenberg,	Bangor,	Pa.	Milton S. Apple, M.D.
Appmann. William,	San Antonio,	Texas	Jno. W. Bodenmann.
Barnard, William Dwight,	Manistee,	Mich.	A. H. Lyman.
Barwig, Gustavus Adolphus,	Philadelphia,	Pa.	Dr. G. A. Bachman.
Baskin, Mortimer Horning.	Harrisburg,	Pa.	M. H. Bickley, Ph.G.
Belt, James Ferris,	Wilmington,	Del.	Z. James Belt.
Bender, John Jacob,	Shippensburg,	Pa.	S. S. Loughridge, Ph.G.
Benerman, Alan Herbert,	Philadelphia,	Pa.	H. C. Blair's Sons.
Bennum, Charles Henry,	Georgetown,	Del.	A. W. Duvall, M.D.
Berkemeyer, Francis Molton,	Kutztown,	Pa.	L. C. Berkemeyer, M.D.
Berkstresser, Watson J.,	Huntington,	Pa.	J. H. Black & Co.
Besore, Abraham Lincoln,	Shippensburg,	Pa.	U. D. E. Hayes.
Bickel, Harry Lee,	Felton,	Del.	F. E. Morgan, Ph.G.
Bilderback, Joseph Brown,	Pennsgrove,	N. J.	J. T. White.
Bilheimer, John Jessiah,	Bath,	Pa.	Dr G. P. Kern & Son.
Blackwood, Russell Thorn,	Bristol,	Pa.	J. R. Smyser, Ph.G.
Boecking, Carl Guido,	Tyrone,	Pa.	Saml. Gerhard.
Bolton, Joseph Peeky,	Germantown,	Pa.	Dr. J. M. Bradford, Ph.G.
Bonnell, Alexander Carhart,	Clinton,	N. J.	Dr. B. F. Severs.
Bowman, George McLeod,	Washington,	D. C.	C. B. Hunterson, Ph.G.
Bowman, John M.,	Philadelphia,	Pa.	F. W. Heyl.
Boyer, Allen Webster,	Allentown,	Pa.	W. E. Moyer, Ph.G.
Breisch, William H.,	White Haven,	Pa.	C. M. Driggs.
Brick, Harry Walter,	Fitchburg,	Mass.	Dr. Geo. M. Bowen.
Bright, William Willits,	Muncy,	Pa.	Watt & Leedom.
Brennan, John Thomas,	Philadelphia,	Pa.	F. M. Geary.
Buchanan, Frank,	Crum Lynne,	Pa.	C. H. Roberts, Ph. G.

Name.	*Place.*	*State.*	*Preceptor.*
Buehl, Edward Herman,	Massillon,	Ohio	E. S. Craig, Ph. G.
Bugg, Zack W.,	Blandville,	Ky.	S. J. Coffee, Ph. G.
Burgess, Frank Eugene,	Jefferson,	Ohio	Dr. E. H. Evans, Ph.G.
Burnett, James Howard,	Camden,	N. J.	L. B. Hirst, Ph. G.
Burnett, William Prescott,	Hackensack,	N. J.	John P. Burnett.
Butterworth, Francis James,	Lenni,	Pa.	Dr. C. L. Lashelle.
Cadmus, Alfred Brooks,	Philadelphia,	Pa.	F. J. Knauss.
Caldwell, Florence Moore,	Germantown,	Pa.	S. W. Caldwell, M. D.
Campbell, Clarence Henry,	Easton,	Md.	M. Campbell, Ph. G.
Carey, Wm. James,	Emporium,	Pa.	Dr. R. P. Heilman.
Carney, George Elmer,	Philadelphia,	Pa.	Hance Bros. & White.
Carriat, Louis, Michel,	Philadelphia,	Pa.	
Carritte, Clarence Edgar,	St. Paul,	Minn.	J. P. Carritte.
Cartwright, Benj. Franklin,	Philadelphia,	Pa.	Dr. Wm. Delker.
Casey, Harry English,	Philadelphia,	Pa.	Bullock & Crenshaw.
Cassiday, John Francis,	Philadelphia,	Pa.	W. H. Pile & Son.
Castle, Abraham Lincoln,	Upland,	Pa.	J. J. Parker.
Christ, Franz,	Philadelphia,	Pa.	John D. Moore, Ph. G.
Christman, Albert Samuel,	Allentown,	Pa.	E. J. Danowski.
Churchill, Jerome Percy,	Yreka,	Cal.	F. S. Ackerman.
Clabaugh, Edgar Michael,	Altoona,	Pa.	D G. Hurley, Ph. G.
Clapham, Benson Grant,	Mifflinburg,	Pa.	H. C. Clapham, Ph. G.
Codville, Harry Lawson,	Philadelphia,	Pa.	C. G. A. Loder, Ph. G.
Coley, Lemuel Belah,	Alexander City,	Ala.	E B. Rainey.
Coleman, Samuel,	Harrisburg,	Pa.	L. A. Dix.
Collings, Walter Nagle,	Philadelphia,	Pa.	D. W. Flemming.
Cook, Francis Wade,	Royersford,	Pa.	M. H. Bickley, Ph.G.
Cope, Frank Henry,	Philadelphia,	Pa.	J. M. Higgins.
Crothers, James Lawson,	Zion,	Md.	W. H. Lantz.
Cullen, James Kimmey,	Camden,	Del.	F. H. Davis.
Dalton, David,	Upland,	Pa.	D. Alfred Dalton.
Darling, Dwight Kellum,	Whatcom,	Wash. Ter.	H. H Sheik.
Davis, Alvah Molony,	Norristown,	Pa.	O. F. Lenhart, Ph. G.
Day, Frederick Samuel,	Philadelphia,	Pa.	Bullock & Crenshaw.
De La Cour, Joseph Carl,	Camden,	N. J.	J. C. De La Cour.
Dewees. Jacob Highley,	Norristown,	Pa.	Wm. Stahler.
Dierolf, Charles B ,	Mt. Joy,	Pa.	Dr. J. F. Meade.
Dillon. Jr., Thomas Henry,	Philadelphia,	Pa.	Dr. J. M. Malatesta, Ph. G.
Donnell, George James,	Downingtown,	Pa.	G. E. Dennison.
Dubbs, Robert Lovine,	Allentown,	Pa.	S. Gerhard, Ph G.
Dunning, Fredk.,	Denton,	Md.	Dr. E. Q. Thornton, Ph. G.
Dunwody, Richard Gaillard,	Brunswick,	Ga.	Dr. Jno. A. Dunwody.
Duff, Peter Nicholas,	Dublin,	Ireland	S. Campbell, Ph. G.
Eberhardt, Ernest Godlove,	Indianapolis,	Ind.	Eli Lilly & Co.
Eberhardt, Wm. Fred.,	Fond du Lac,	Wis.	Ditter, Mitchell & Co.
Eby, Edwin Stanton,	Newport,	Pa.	B. M. Elby.
Engelman, Henry Shaffer,	Easton.	Pa.	Weaver & Hohl.
England, William Taws,	Philadelphia,	Pa.	Robt. England, Ph. G.
Eppley, John Hake,	York,	Pa.	Dr. W. K. Mattern, Ph.G.
Eyer, Harry Bowman,	Everest,	Pa.	C. G. Masters.
Faries, Joseph Benjamin,	Smyrna,	Del.	S. P. Wright, Ph. G.
Feidt, George David,	Hagerstown,	Md.	Chas. Ouram, Ph. G.
Finkeni, Wm. C.,	Camden,	N. J.	Dr. G. W. Henry.
Fletcher. Thomas Milton,	Little Rock,	Ark.	W. H. Haliburton.
Fraunfelder, Richard Deily,	Easton,	Pa.	A. Y. Gerhard & Co.
French, Adelbert Porter,	Susquehanna,	Pa.	H. E. Outwater.
French, Francis Freas,	Philadelphia,	Pa.	W. H. Koons, Ph. G.
Frontz, Edward Elmer,	Hughesville,	Pa.	Dr. W. C. Stillwell, Ph G.
Garland, John Kistler,	Centre,	Pa.	Dr. Van Cleef.

Name.	*Place.*	*State.*	*Preceptor.*
Gervais, Wm. Jos. Napoleon,	Elmira,	N. Y.	Dr. H. B. Taylor, Ph.G.
Gibble, Elmer Ellsworth,	Manheim,	Pa.	J. Howard Evans, M. D.
Gibbony, David Clarence,	Lisbon,	Iowa.	S. Kettering.
Gibson, Robert,	Shepherdstown,	W. Va.	O. H. Musser, Ph. G.
Gill, Charles A.,	Hulmeville,	Pa.	O. H. Musser, Ph. G.
Glenk, Robert,	Philadelphia,	Pa.	W. T. Baker, Ph. G.
Goll, Philip,	Philadelphia,	Pa.	W. J. Schaffer.
Gordon, Jean,	Walnut Hills,	Ohio	Wm. B. Gleim.
Gosh, William Edgar,	Danville,	Pa.	W. E. Mack.
Gotwalt, Samuel Horace,	York,	Pa.	B. S. Gilbert, Ph. G.
Gracey, Archibald Alexander,	Philadelphia,	Pa.	W. B. Banks, Ph. G.
Griffith, Joseph Thomas,	Sassafras,	Md.	Dr. C. G. Frowert.
Guest, Harry,	Swedesboro,	N. J.	L. B. Hirst, Ph. G.
Hackenberger, Geo. Wash'gton,	Bainbridge,	Pa.	H. C. Blair's Sons.
Hackney, George Wyly,	Uniontown,	Pa.	Daniel S. Jones, Ph.G.
Hall, Marlborough,	Philadelphia,	Pa.	H. C. Blair's Sons.
Hallowell, Bruce Clyde,	Frankford,	Pa.	Geo. S. R. Wright.
Hamberg, Samuel Tilden,	Washington,	Pa.	J. F. Judd, Ph. G.
Hance, Edward Hance, Jr.,	Germantown,	Pa.	Hance Bros. & White.
Hanson. Arthur Edward,	Brazil,	S. A.	J. J. Ottinger, Ph. G.
Harbold, Curtis Alexander,	York,	Pa.	J. M. Ruegenberg.
Hasson, Harry Decora,	Phillipsburg,	Pa.	D. H. Ross, Ph. G.
Hendrickson, Chas Palmatary,	Dover,	Del.	Cowgill & Green.
Hennessy, Frank Augustine,	Charlotte,	Mich.	H. K. Mulford & Co.
Herbein. George Winters,	Sinking Springs,	Pa.	H. G. Haring.
Henkel, Luther Samuel,	Catawissa,	Pa.	E. H. Baker.
Hickman, Thomas Ellwood,	Lombard,	Md.	Wm. H. Hickman.
Hills, Daniel Henry,	Jamestown,	N. Y.	Wilmot Hansell.
Hornby, Walter Melvin,	Roxboro,	Pa.	H. H. Anderson.
Howard, Carrie Emily,	Philadelphia,	Pa.	H. Barr Snavely, Ph.G.M.D.
Hughes, Frank Stacker,	Norristown,	Pa.	James G. Wells.
Hurxthal, H. Lewis,	Massillon,	Ohio.	E. A. Richmond.
Jacob, Walter William,	West Grove,	Pa.	Geo. B. Evans, Ph.G.
Jacob, Charles Pim,	West Grove,	Pa.	Geo. B. Evans, Ph.G.
Jager, Charles Mathias,	Chattanooga,	Tenn.	F. H. Dowler & Co.
Janson, Edwin Leonard,	Canton,	Ohio.	Weber Bro.
Johnson, A. R.,	Henderson,	Ky.	W. S. Tolinson.
Johnson, Frank R.,	Chester,	Pa.	G. Frank Wilson.
Johnson, William Anthony,	Philadelphia,	Pa.	Emil Jungmann.
Jones, W. Lincoln,	Catasauqua,	Pa.	
Judge, John Aloysius,	Philadelphia,	Pa.	Bullock & Crenshaw.
Keller, Augustus Herman,	Philadelphia,	Pa.	A. G. Keller.
Keller, Benjamin C.,	Manchester,	Iowa.	L. Atwater & Son.
Kendig, Allen Jesse,	Philadelphia,	Pa.	R. P. Marshall, Ph. G.
Keppler, Charles Lewis,	New Orleans,	La.	C. L. Keppler.
Kitzmiller, Frank Kurtz,	Harrisburg,	Pa.	D. W. Gross & Sons.
Kizer, Harry Stiles,	Wilmington,	Del.	H. C. Snitcher, M. D.
Knowles, George Alexander,	Philadelphia,	Pa.	W. D. Kerr.
Koons, Milton Henry,	Catasauqua,	Pa.	Edw. D. Boyer, Ph. G.
Krauss, Frederick,	Philadelphia,	Pa.	George Billé, Ph. G.
Kunkle, William Henry,	Salladasburg,	Pa.	F. P. Albright Ph. G.
Laessle, Henry Adolph,	Philadelphia,	Pa.	Dr. F. Seitz.
Lammer, Henry Bruno,	Philadelphia,	Pa.	Bullock & Crenshaw.
Lammer, Jacob Sigmund,	Philadelphia,	Pa.	F. J. Lammer, Ph. G.
Landis, Charles Paul,	Philadelphia,	Pa.	C. Petzelt.
Leigh, Charles Neal,	Coxsackie,	N. Y.	H. C. Manlove, Ph. G.
Lesher, Edwin Charles,	Berks,	Pa.	
Lippen, Jonathan Knight,	Salem,	N. J.	H. M. Levering.
Loelkes, Alexander George,	Belleville,	Ill.	E. Reuss.

Name.	*Place.*	*State.*	*Preceptor.*
Loesch, Jr., Wm.,	Philadelphia,	Pa.	W. E. Lee, Ph. G.
Long, Christian Charles,	Shippensburg,	Pa.	Dr. T. E. Conard, Ph. G.
Lowry, Sidney Alfred,	Yorkville,	S. C.	Lowry & Starr.
Lutz, Irwin Brennan,	Blainesport,	Pa.	H. G. Haring, Ph. G.
Lutz, Wm. Dellet,	Germantown,	Pa.	L. A. Treichler.
Mack, John Sandford,	Slatington,	Pa.	J. E. Williams.
Mackey, Edward Scudder,	Belvidere,	N. J.	Faust Bros.
MacWilliams, Samuel,	West Grove,	Pa.	Robt. Brick.
McCandless, Edward Sloan,	Philadelphia,	Pa.	H. S. Bartlett.
McClure, Linwood Dunham,	Philadelphia,	Pa.	Budd, Butterworth & McClure.
McCorkle, William,	Oxford,	Pa.	T. A. Walker.
McCullough, Madison Lovett,	Oxford,	Pa.	C. B. McCullough.
McManus, Joseph,	Upland,	Pa.	F. G. Ryan, Ph. G.
Martin, William Frederick,	Kansas City,	Mo.	J. C. B. Eager.
Marvill, Joseph Howard,	Philadelphia,	Pa.	J. F. Yealy, Ph. G.
Mentzer, Harlan Joseph,	Waynesboro,	Pa.	J. H. Fredericks, Ph. G.
Merkel, Wm.,	Minersville,	Pa.	Dr. J. M. Bradford, Ph. G.
Meyers, Quillas Albert,	Petersville,	Pa.	S. M. Hohl.
Miller, Wm. Edward,	Camden,	N. J.	H. W. Miller.
Miller, Wm. Haman,	Dover,	Del.	Dr. T. D. Marshall.
Miner, Mrs. M. O.,	Hiawatha,	Kansas.	Thomas Stevens.
Moor, Jr., Edward,	Media,	Pa.	S. E. R. Hassinger, Ph. G.
Moore, Wm. David,	Connelsville,	Pa.	J. C. Moore.
Morgan, George Irvin,	Lynn,	Mass.	F. E. Morgan.
Morrison, John William,	Amherst,	N. S.	R. C. Faller.
Mueller, Charles August,	Philadelphia,	Pa.	A. G. Keller.
Mulheron, John Dunaway,	Brownsville,	Tenn.	Jos. Crawford, Ph. G.
Murray, Emmett Leroy,	Americus,	Ga.	H. K. Mulford, Ph. G.
Myers, Frank,	Harrisonburg,	Va.	Bullock & Crenshaw.
Myers, William Tice,	Myerstown,	Pa.	C. C. Hagenbush.
Nichols, John Baugh,	Philadelphia,	Pa.	G. C. Webster, Ph. G.
Nickumn, Elwood George,	Bethlehem,	Pa.	Dr. C. B. Lowe, Ph. G.
Nolin, William Mosby,	Hannibal,	Mo.	DeGarris Bro.
Odbert, James Henry,	Wheeling,	W. Va.	T. H. Potts, Ph. G.
Ogden, Charles Sheppard,	Camden,	N. J.	W. F. Richards.
Peacock, Josiah Comegys,	Millington,	Md.	J. W. Kohlerman, Ph. G.
Pentz, John Flemming,	Easton,	Pa.	S. M. Hohl.
Perronet, Emile Alfonso,	Philadelpnia,	Pa.	T. M. Galbraith, Ph. G.
Pfeiffer, Charles Alfred,	Baltimore,	Md.	J. H. Evans, M. D.
Pfromm, Geo. Washington,	Philadelphia,	Pa.	D. S. Wittberger.
Platt, George Fisk,	Chambersburg,	Pa.	H. A. Newbold, Ph. G.
Porter, Crawford Washington,	Philadelphia,	Pa.	Robt. McNeil.
Prass, John Nicholas,	Dayton,	Ohio	W. H. Hyers.
Pratt, Wm. Henry,	Camden,	N. J.	L. H. Wilson.
Prior, Edwin Alfred,	Williamsport,	Pa.	M. Huber, Ph. G.
Proctor, J. Elliott,	Wooster,	Ohio	A. W. Blakman.
Ranftle, Oscar,	Long Island City,	N. Y.	W. E. Lee, Ph. G.
Raub, Fred. Miller Dickson,	Lancaster,	Pa.	Dr. W. M. Raub.
Rasmusen, Otto,	River Falls,	Wis.	C. E. Davis.
Read, Ralph Maynard,	Osceola Mills,	Pa.	Dr. F. B. Read.
Reese, David John,	Scranton,	Pa.	C. Carroll Meyer, Ph. G.
Reizenstein, Albert George,	Lebanon,	Pa.	Dr. Geo. Ross & Co.
Remington, Samuel Jacob,	Philadelphia,	Pa.	Stryker & Ogden.
Reynolds, May,	Philadelphia,	Pa.	A. M. Reynolds, M. D.
Rhodes, Charles Reynolds,	Orrstown,	Pa.	Wm. H. Faunce, Ph. G.
Richards, Davis Bruce,	Philadelphia,	Pa.	Wm. Weber.
Richardson, James Henry,	Charlestown,	Md.	L. R. Kirk, M. D.
Richardson, Harry,	Dover,	Del.	Dr. C. E. Hewitt, Ph. G.
Richter, Gustave Adolph,	Philadelphia,	Pa.	Dr. J. D. Grove, Ph. G.

Name.	*Place.*	*State.*	*Preceptor.*
Rohrer, Howard,	Lancaster,	Pa.	H. B. Cochran.
Rolleston, Arthur Raymond,	Philadelphia,	Pa.	Harry Cox, Ph. G.
Ross, Eben Jackson,	Oxford,	Pa.	Geo. Cooke.
Ross, H. Frank,	Russelville,	Pa.	E. W. Jester.
Roth, Theo. W.,	Philadelphia,	Pa.	Dr. G. H Ischler, Ph. G.
Rudy, Jacob Albert,	York,	Pa.	Dr. C. B. Lowe, Ph. G.
Ruff, U. Gilbert,	Bryansville,	Pa.	S. E. R. Hassinger, Ph.G.
Rutherford, Frank Parke,	Cochransville,	Pa.	G. P. Scheeble, Ph. G.
Sample, Joseph Frank;	Mechanicsburg,	Pa.	J. A. Shelly, Ph. G.
Sandifer, Myron Harry,	Sumter,	S. C.	J. F. Loerne.
Schade, George Julius,	Sandusky,	Ohio	O. F. Lohmann.
Schetky, Laurence Oliphant,	Mt. Holly,	N. J.	Bullock & Crenshaw.
Schick, Frederick Martin,	Bellaire,	Ohio	Harrington & Pennypacker.
Schindel, Harry Ellsworth,	Hagerstown,	Md.	L. C. Funk, Ph. G.
Schloer, Charles Albert,	New York,	N. Y.	W. D. Stevenson,
Schminky, Allen Beecher,	Gratz,	Pa.	Dr. C. D. S. Frûh, Ph.G.
Schoff, J. John,	Annapolis,	Md.	A. J. Corning,
Schoppe, L. A.,	St. Louis,	Mo.	
Schraedly, Fred'ck Abraham,	Locustdale,	Pa.	Bullock & Crenshaw.
Schultz, Albert,	Scranton,	Pa.	T. D. Lewis.
Schultz, G. Emile,	Chester,	Pa.	
Scott, Theodore William,	Oak Hill,	Pa.	Chas. H. Clark, Ph. G.
Seler, Charles Augustus,	Allentown,	Pa.	Dr. Hiestand.
Shaw, Henry Burfield,	Canada.		M. Kratz, Ph. G.
Sheafer, Edward Parke,	York,	Pa.	G. E. Dahis, Ph. G.
Sheehan, John Peter,	Utica,	N. Y.	G. B. Evans, Ph. G.
Shomberg. Albert Frederick,	Altoona,	Pa.	G. A. Beckley.
Shreve, Joseph Frith,	Jacksonville,	Ill.	Jas. Williamson, Ph. G.
Sipe, George Walter,	Carlisle,	Pa.	G. D. Keller, Ph. G.
Sitgreaves, Wesley Cline,	Vincentown,	N. J.	F. S. Hilliard.
Smith, Charles Oscar,	Hartleton,	Pa.	M. L. Mench, M.D.
Smith, Fred Harlow,	Springfield,	Mass.	H. & J. Brewer.
Smith, Frederick William,	Loudonville,	Ohio	Geo. Holland, M. D.
Smith, George Anselm,	Nazareth,	Pa.	B. C. Waterman, Ph. G.
Snuggs, Stephen Gregory,	St. Louis,	Mo.	H. F. MacCartney.
Sombart, Joseph Louis,	Coldwater,	Kansas	Dr. J. E. Sombart, Ph.G.
Sontag, George Lewis,	Neillsville,	Wis.	C. C. Sniteman, Ph. G.
Southerland, Thomas Raibe,	Wilmington,	N. C.	J. H. Hardin.
Spragle, Elmer,	Bartonsville,	Pa.	G. W. Barton.
Sprissler, Clara,	Philadelphia,	Pa.	Dr. Theo. Sprissler, Ph.G.
Spruance, James Harvey,	Smyrna,	Del.	O. C. Spear, Ph. G.
Stangl, Paul Louis,	Philadelphia,	Pa.	A. Stangl.
Steiner, Ephraim Henry,	South Easton,	Pa.	A. N. Richards.
Stettzer, Nathan Samuel,	Philadelphia,	Pa.	J. A. Martin, Ph. G.
Stewart, Abraham Lincoln,	Philadelphia,	Pa.	C. L. Young.
Stout, Oliver,	Philadelphia,	Pa.	J. L. Supplee, Ph. G.
Strohecker, Samuel Martin,	Reading,	Pa.	W. A. Burns, M.D.
Stroud, J. Geary,	Port Providence,	Pa.	D. G. Potts.
Stimmel, Walter,	Wilmington,	Del.	Peter Stelman.
Swainbank, Harry Harlan,	Wilkesbarre,	Pa.	Matt Wolfe & Co.
Sullivan, Charles Edwin,	Wilmington,	Del.	Jas. M. Griffin.
Taylor, Harry Baker,	Altoona,	Pa.	E. L. Taylor.
Thompson, Charles Leonard,	Wilmington,	Del.	Jno. M. Harvey.
Thompson, Ebenezer Francis,	Titusville,	Pa.	E. R. Thompson.
Thompson. Wm. Franklin,	Harrisburg,	Pa.	G. A. Gorgas.
Thomson, Frank Frazer,	Carlisle,	Pa.	W. H. Llewellyn, Ph.G.
Tinsman, John Fine,	Bloomsbury,	N. J.	A. J. Odenwelder.
Trauck, Charles Cowdrick,	Philadelphia,	Pa.	E. C. Jones & Co.
Troutman, George Franklin,	Glen Riddle,	Pa.	Dr. C. L. Lashelle, Ph.G.

Name.	*Place.*	*State.*	*Preceptor.*
Turner, Herbert Wilkinson,	Altoona,	Pa.	C. F. Randolph, Ph. G.
Tyler, George Cone,	Bristol,	Pa.	R. C. Cadmus, Ph. G.
Uhler, Samuel Elliott,	Carlisle,	Pa.	J. E. Sipe.
VanDyke, Alfred Nelson,	VanDyke,	Pa.	
VanValzah, John Adams,	Philadelphia.	Pa.	W. D. Heiser.
Venn, Joseph,	Memphis,	Tenn.	I. Goldbaum.
Visanska, Samuel Albert,	Abbeville,	S. C.	Given & Co.
Wallace, Harlan Lewis,	Seaford,	Del.	W. F. Haines & Co.
Watson, Hite,	Charlestown,	W. Va.	Geo. T. Light.
Warren, Nathan Chew,	Upland,	Pa.	Dr. C. L. Lashelle, Ph.G.
Weiler, John Wilson,	Emaus,	Pa.	H. B Taylor, Ph.G.
Weiss, Frederick Andrew,	Del Norte,	Col.	Weiss Chapman Drug Co.
Wells, Fred. Barton,	Vineland,	N. J.	S. W. Gadd, M.D.
Welsh, Oscar Connor,	York,	Pa.	Dale, Hart & Co.
Westcott, William Custer,	Atlantic City,	N. J.	E. S. Reed.
Wilbert, Martin Inventius,	Utica,	N. Y.	G. W. Shingle.
Williams, Daniel Albert,	Plymouth,	Pa.	B. Armstrong.
Williams, John Henry,	Slatington,	Pa.	W. O. Davies, Ph. G.
Williamson, James Strickler,	Norristown,	Pa.	Dr. Theo. Jacobs.
Wishart, John Elmer,	Harrisonville,	Pa.	J. B. Ferguson.
Wittel, John Kaler,	Florin,	Pa.	Leidy Seipel.
Wittiger, Hugo Otto,	Bethlehem,	Pa.	J. M. Shoffner, Ph.G.
Woertz, George Augustus,	Philadelphia,	Pa.	W. A. Auffurth, M.D.
Wolf, Frederick Joseph,	Philadelphia,	Pa.	R. Shoemaker & Co.
Wolfenden, Benj'n Franklin,	Upland,	Pa.	W. Procter, Jr., Co.
Woodall Junius Pascal,	Smithfield,	N. C.	C. E. Spenceley, Ph.G.
Worrall, Harry,	Wilmington,	Del.	N. B. Danforth, Ph.G.
Wright, John Armstrong,	Philadelphia,	Pa.	A. W. Wright.
Yealey, Tilghman Wesley,	Camden,	N. J.	Jyhn W. Frey.
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